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Kata Pengantar

Puji syukur kehadirat Allah SWT atas limpahan rahmat dan karunianya sehingga Buku Proceeding 4th ICTROPS tahun 2020 telah dapat diselesaikan. Buku ini sebagai produk keluaran dari kegiatan 4th ICTROPS yang telah dilaksanakan pada 28 Oktober 2020.

Terimakasih disampaikan kepada Prof Dr. Masjaya M.Si. selaku rektor universitas Mulawarman dan Dr. Sc. Mutaid Yusuf selaku Kepala PIU-IsDB Universitas Mulawarman atas dukungan dan arahan yang telah diberikan dalam penerbitan buku ini.

Kami menyadari masih terdapat kekurangan dalam buku ini untuk itu kritik dan saran terhadap penyempurnaan buku ini sangat diharapkan. Semoga buku ini dapat memberi maanfaat bagi seluruh civitas akademika di Indonesia pada umumnya dan Universitas Mulwarman pada khususnya.

Samarinda, Oktober 2020
Ketua Pelaksana

Rusfina Widayati, S.T., M.Sc.

Sambutan Rektor

Assalamu 'alaikum wr wb. (May peace be upon you)

First of all, let us thank Allah, the Almighty, for blessing and guiding us into the right path, and for granting all means and opportunities together here to attend this very meaningful occasion.

On behalf of the Mulawarman University, we are greatly honored and pleased to welcome you all to the Second International Conference on Tropical Studies and Its Application (ICTROPS) 2020 on **"Measuring the Readiness of Maritime Aspect to Support Tropical City of The New Capital of Indonesia**".

The framework of Mulawarman University as a "Center of Excellence for Tropical Studies" as a part of the 4 in 1 initiative. This initiative is projected to excel in Teaching and Learning, Research and Innovation, and Staff Development as soft programs and Campus Infrastructure as hard program. With the assistance of this IsDB program, the 4 in 1 initiative has two umbrella programs of research consortium and curricula development. The outcomes of this initiative are competent graduates, publication, and quality of teaching-learning, excellent services, student quality, academic atmosphere, IPR, prototypes, research collaboration, and employability. In short, the 4 in 1 consortium will have a positive impact on developing nation competitiveness by providing competent graduates, collaboration in research, academic reputation, and excellent services and management.

We would also like to extend our gratitude especially to all speakers, participants and committees.

Wassalamu'alaikum wr. wb.

Samarinda, 2020
Rector,

Prof. Dr. H. Masjaya, M.Si

Sambutan Direktur Eksekutif PIU-IsBD

Assalamu 'alaikum wr wb. (May peace be upon you)

The important role of this IsDB project is as an enabler for Mulawarman University to achieve as a Service Excellence on Center for Tropical Studies (SE-CTS) by developing five key sectors namely Campus Infrastructure (CI), Teaching and Learning (T&L), Research, on Campus Service (CS), and Public Services (PS). The project will indirectly benefit GDP of the nation as a result of higher quality of education. It is expected that the project will increase the quality of graduates, both in academic skills as the core competence and soft skills as an essential added value. It is projected that the project becomes an important trajectory for qualified human resources that are heavily in need to face the embracing ASEAN Economic Community and possibly Trans Pacific Partnerships. Samarinda as the host city for Mulawarman University and East Kalimantan province will also economically benefited through the coming of more young researchers.

The International Conference on Tropical Studies and Its Application annual conference on October 28th 2020, is organized by Mulawarman University in collaboration with Islamic Development Bank (IsDB) and Ministry of Research, Technology, and Higher Education of The Republic of Indonesia.

On behalf of Project Implementation unit (PIU) Islamic Development Bank (IsDB) of Mulawarman University, We would also like to extend our gratitude especially to all speakers, participants and committees.

Wassalamu'alaikum wr. wb.

Samarinda, 2020
Executive Director of PIU-IsDB,

Dr. Sc. Mustaid Yusuf, M.Si

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Drying of Onion Tiwai (*Eleutherine americana (palmifolia) l. Merr*) with Conduction and Convection Based Electric Dryer

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Abstract

Drying research has been carried out using electric dryers on a laboratory scale to dry the raw ingredients of Tiwai onion herbs. This activity aims to know the drying rate of the ingredients that have been tested, namely Tiwai onions (tubers, leaves, and roots), by using a conduction and convection-based electric dryer. In this study, tubers and leaves were sliced while the roots were not cut, then dried at a temperature of 50^oC until the sample reached the balance water content. Each sample was analyzed in triplicate. Observed responses include drying rate and moisture content. Drying results show drying against tubers, leaves, and tiwai onion roots using an electric dryer will produce a moisture content of 2.24% - 3.85% with a drying temperature of 50^oC, with drying time between 1.9 and 2.5 hours. The Page model best represents the drying rate of tiwai onion. The determination coefficient (R^2) of the drying rate equation shows a good correlation > (0.8).

***Keyword**: drying rate, Tiwai onion, electric dryer, conduction, convection*

Introduction

Drying is the oldest means of preservation of foodstuffs. This process aims to preserve grains, fruits, and vegetables. The drying process aims to reduce the moisture content to a safe storage level for some time. Water content that has dropped to some extent can decrease the rate of material damage due to biological and chemical activities before the material is processed (Adiletta in Rahmadi, A: 2016).

Over natural drying and artificial drying distinguish the sophistication of the resulting products (Hall in Amen, S: 2018). Natural drying means drying under the sunlight, while artificial drying uses a mechanical dryer. Generally, drying uses sunlight due to low operating costs (Hii in Rahmadi, A:2016). But in this way, the drying rate's stability is challenging to obtain due to unstable temperature during the drying process (Bal in Rahmadi, A: 2016). The traditional drying problem can be solved by drying with the help of drying equipment, an electric dryer. It is expected to facilitate the drying process, shorten the drying time, and improve the dried products' quality. (Rozana, 2016).

Dryers with low relative humidity will be sufficient for drying the material, as moisture from the material will release into the dryer air, to be further discharged out of the system (Fudholi in Rahmadi, A:2016). The drying rate in the continuous system is generally done by measuring the dryer system's relative humidity. This method is more effective than measuring the material's weight during the drying process (Peglow in Rahmadi, A:2016).
The parameters that affect drying time are temperature, humidity, airflow rate, initial water content, and water content of dry materials (Hii in Rahmadi, A:2016). The relative humidity between the air and the dried material is due to the water evaporation into the air. The difference in relative humidity is the basis of the drying process calculation (Peglow in Rahmadi, A:2016). This research aims to determine the ingredients tested's drying rate, namely Tiwai onions (tuber parts and their roots), using conduction and convection stale electric dryers.

Materials and Methods

The materials used in this study are; Onions are obtained from traditional markets. The equipment used in this study was an electric dryer (heater 104 Watts, two incandescent lamps of 100 Watts each, DHT 22 sensor with a sensitivity of 0 to 100% and accuracy of ±5% (Saptadi, 2014), fan, Arduino microcontroller, digital scale, and laptop. This research was conducted in the Laboratory of Packaging and Processing of Agricultural Technology Faculty of Agriculture, Universitas Mulawarman Samarinda.

Figure 1. Electric dryer used

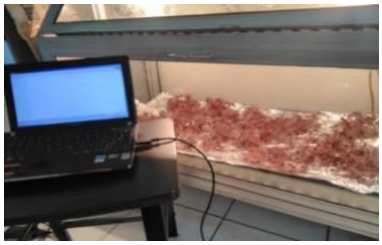

Figure 2. Laptop-connected power dryer for data retrieval

Trial Design and Data Analysis

This type of research is an experimental study, consisting of 2 factors. Factor A is onion tiwai (tubers, leaves, and roots), and Factor B is the drying temperature of 50°C. Thus the number of treatments tried there are as many as three combinations of treatments. Each variety of treatments is repeated three times. The tubers are sliced, and the leaves are cut first before going into the dryer. Water content analysis was conducted according to SNI 3836:2013 (Dry Tea in Packaging). The data is then processed using Microsoft Excel version 2016 to calculate the moisture ratio (MR) value and determine the linear regression of the Page model formula.

Page model

The drying rate equation has several models, such as the Lewis model equation model and the Page model. The rate can be processed using equilibrium water content data, initiation water content, and water content at t. Page model equations are generated by plotting the ln(t) variable on the x-axis and the ln(-ln MR) variable on the y-axis. This equation's constant drying value is taken from the exponential intercept, while the n coefficient value is taken based on its slope value.

The drying ate can be calculated from the decrease in water content over time. More precise calculations can be done using the equation approach of the drying rate model. The drying rate equation applied in this study follows Page's model (Erbay and Icier, 2010).
Page's model is a modification of the Lewis model (lewis model is page model with n=1) intending to get a more accurate model. Page's model is widely used to characterize the thin-layer drying of cereals, oilseeds, ear corn, and cloves (Jayas et al.,1991).

$$MR = \frac{M_i - M_e}{M_o - M_e} = \exp(-kt^n) \quad \text{.....(1)}$$

To measure MR used equations (1), consisting of moisture values on its second (Mi) is reduced by the amount of moisture in the equilibrium (Me) condition. This result is then divided by the value obtained from reducing the initial moisture value (Mo) against Me (Boubekri et al. 2009).

Equations (1) can be made linear by adding natural logarithmic on both sides of the equation (Muhandri, 2015).

$$\ln(-\ln MR) = \ln(k) + n(\ln t) \quad \text{.....(2)}$$

Results and Discussion

Drying Rate on Time

The drying rate is an overview of a product's speed against the time it takes to lower the material's moisture content. Evaporation of water mass from the surface of the material will increase rapidly with the temperature increase in the drying process. The evaporation rate's speed during drying will determine the value of the drying rate during the drying process. The drying rate in the continuous system is done by measuring the relative humidity obtained from the sensor data in the dryer system, as this method is faster and more effective than measuring the weight of the material during the drying process (Peglow in Rahmadi, 2018). The drying rate pattern on tiwai onion bulb drying is presented in Figure 3.

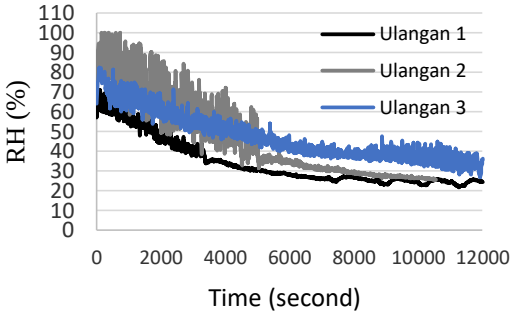

Figure 3. The rate of drying of Tiwai onion bulbs against the time at each replay at 50^{0}C

(a) (b)

Figure 4. (a) Tiwai onion bulbs before drying (b) Tiwai onion bulbs (sliced) that have been dried using an electric dryer

Figure 3 shows that the drying rate for all three replicates at the earliest start time is high but then decreases rapidly. This is because, at that time, the water content is still high, so the diffusion of water to the surface of the thallus takes place quickly. The rate of drying tends to fluctuate. These fluctuations are caused by external factors, including temperature, humidity, and airspeed. At the beginning of the period, the heater's temperature will rise and has not been constant. The variability of readings corresponds to the tendency of heaters that have achieved optimum (stable) conditions. Moisture equilibrium is obtained at the 8000th second (about 2.2 hours) until drying is completed at the 12000th second (Figure 3). The drying rate has a ramped shape. The diffusion rate of water vapor from the material to the surface is getting smaller because the more difficult and the greater the distance that must be traveled to get to the material's surface.

The drying tiwai onion bulbs take place from the initial water content of 50.46%bb to the water content of 2.24%bb. The drying rate pattern on tiwai leeks drying is presented in Figure 5.

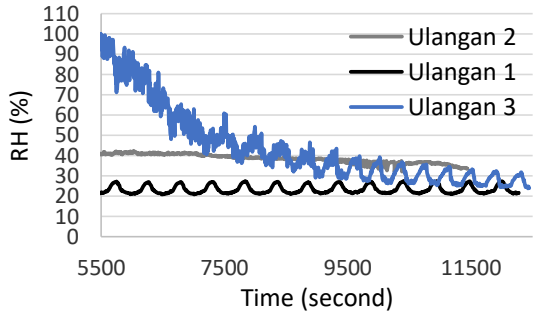

Figure 5. Tiwai leeks drying rate against the time at each replay at 50^{0}C

Figure 6. (a) Tiwai leeks before drying. (b) Dried Tiwai leeks (sliced) using an electric dryer

Figure 5 shows that the drying rate for the third replay at the earliest time is high but then decreases rapidly. At the 9000th second (about 2.5 hours) begins to equilibrium. For the first and second trials, the drying rates were ramp-shaped because the initial water content is low enough from the third replay.

The rate of drying tends to be longer than tiwai onion bulbs. This is related to the tightness of more cells in the leaves than tubers and the initial moisture content. So the time to reach saturation is longer. The drying Tiwai leeks take place from the initial water content of 75.23%bb to the water content of 3.85%bb. The rate of drying of Tiwai onion roots against each replay time is seen in Figure 7 below.

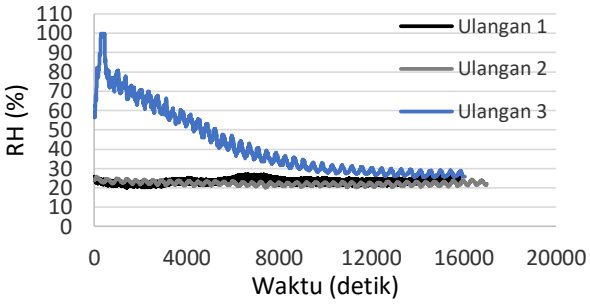

Figure 7. Tiwai onion root drying rate against the time at each replay at 50^{0}C

(a) (b)

Figure 8. (a) Tiwai onion root before drying (b) Tiwai onion root (separated from the tuber) which has been dried using electric dryer

Figure 7 shows that the drying rate for the third replay at the earliest time is high but then decreases rapidly. At the 7000th second (about 1.9 hours) begins to equilibrium. For the first and second repeats, the drying rate is ramp-shaped because the initial water content is low enough from the third replay. The drying rate tends to be faster than tubers and leeks because the surface roots are smaller, so water's evaporation process is more rapid. The process of drying the onion root lasts from the initial water content of 22.54%bb to the water content of 2.6%bb. The moisture content of leaves, tubers, tiwai onion roots is fresh, and after drying is seen in Figure 9 below.

Figure 9 shows that the final moisture content of each tiwai leaf, tuber, and onion root is 3.85%, 2.24%, and 2.6% (the maximum SNI requirement is water content of 8%bb). The average initial moisture content differs at each drying temperature. Water content balance is a function of temperature, relative humidity, physical properties of the material, and the material's initial moisture content (Henderson in Sophia and Mila, 2011).

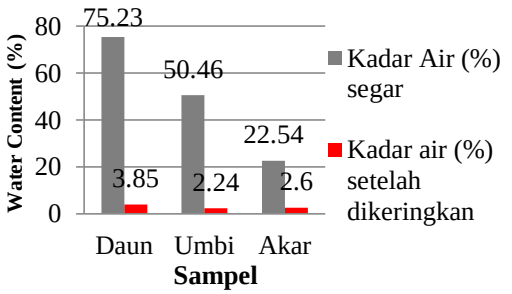

Figure 9. The moisture content of tiwai leaves, tubers, and onion roots is fresh and after drying

Tiwai onion drying rate equation model

The rate of drying of leaves, tubers, tiwai onion roots needs to be approached by modeling using natural logs of relative humidity values. This modeling is assisted by statistical analysis of correlation to ensure that the model is worth using (Rahmadi et al.,2018). The appropriate model describes the drying process in some drying conditions; statistically, valid models are determined by the determination coefficient (R2). A higher R2 value is an indicator used in selecting the appropriate model (Kongkiattisak and Songsermpong,2012); Kaushal and Sharma, 2013). The model used is the Page model. The rate of tuber drying for the best replay taken is seen in Figure 10 to 12 below.

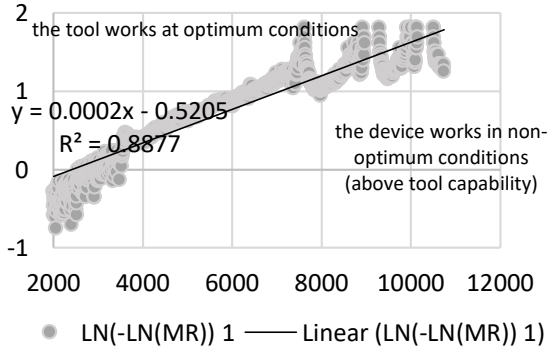

Figure 10. Tiwai onion bulb drying rate at 50^{0}C using the Page model

Figure 10 shows data on dried Tiwai leeks (replay shown best) with a determination coefficient value (R^2) of 0.8877. The multi-determination coefficient suggests that Page's model could describe the drying behavior of Tiwai onion bulbs based on experimental data.

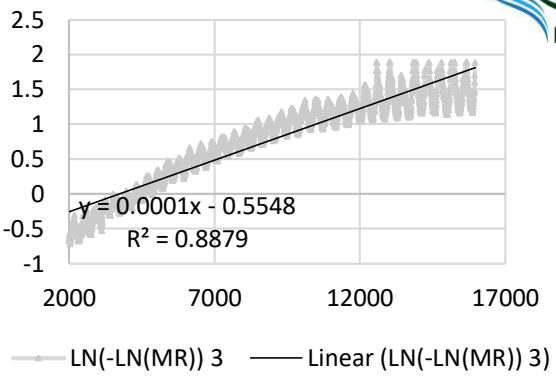

Figure 11. The rate of drying of Tiwai onion roots at each replay at 50^{0}C using the Page model

Figure 11 shows data on dried Tiwai onion root (replay shown best). The coefficient value of its determination (R^2) is 0.8879. It also suggests that Page's model could describe tiwai onion root drying behavior based on experimental data.

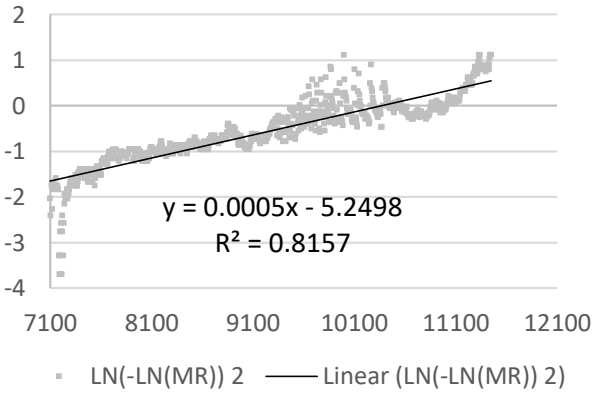

Figure 12. Tiwai leeks drying rate at 50^{0}C using the Page model

Figure 12 shows data on dried Tiwai leeks (replay shown best). The coefficient value of its determination (R^2) is 0.8157. It also showed that Page's model could describe Tiwai's leek drying behavior based on experimental data.

Conclusions

Drying against tiwai bulbs, leaves, and onion roots using an electric dryer will produce a moisture content of 2.24% - 3.85% with a drying temperature of 50^{0}C. With a drying time of 1.9 hours to 2.5 hours. The drying rate of Tiwai onions can be presented well with the Page model. The determination coefficient (R^2) of the drying rate equation using the Page model shows a good correlation > (0.8).

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Synthesis and Charactherization of Chitosan-Tripolyphosphate from Clam Shells (*Cerithidea obtusa)* and Its Application to Sorption of Cadmium Ion

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Abstract

Synthesis and characterization of chitosan-tripolyphosphate (Chi-TPP) from Clam Shells (Cerithidea obtusa) and its application to sorption of cadmium ion has been researched. The Chi-TPP was synthesized using gelation methods by addition tripolyphospate 0,1%. The chitosan was prepared by deacetylation from chitin and this was isolated from Clam Shells (Cerithidea obtusa). The Chi-TPP was characterized using Fourier Transform Infra-Red (FTIR), X-Ray Diffraction (XRD) and Scanning Electron Microscope (SEM). FTIR characterization was indicated the appearance peak of a N-H vibration at 1635 cm^{-1}, functional group of NH_3^+ deformation at 1534 cm^{-1}, streching vibration of a –C-O- at 1072 cm^{-1} and vibration of P-O at 1026,91 cm^{-1} was indicated the presence of TPP. XRD pattern of Chi-TPP showed broad diffraction peaks at 2Θ values of 19.85°, which are thypical fingerprints of Chi-TPP. The lower intensity of Chi-TPP was revealed that its was amorphous. SEM image of Chi—TPP showed cross-linker TPP on chi and stabilizes them. The sorption application of cadmiun ions on Chi-TPP was optimum at pH 4 ie 29.12 mg/g.

Keywords: *chitosan-tripolyphosphate, Clam Shells, cadmium ion*

Introduction

Clam shells (*Cerithidea obtusa)* is clam-spesies from Potamididae familiy and existing is very abundant in beach of Pondong Village, Paser Regency, East Kalimantan. The shells as a waste and unutilized. The utilization of shells waste is processed into chitin and chitosan product. Chitin is poly (β-(1→4)-*N*-acetyl-D-glucosamine from the shell of clam, crab and shrimp. Chitin is collected by deproteinization and demineralization of crustaceans' wastes. The deacetylated form of chitin is chitosan. The result of dyacetilation produces many functional group of amine (-NH_2) dan hydroxil (-OH) (Dutta, *et al.*, 2004). Compared with chitin, chitosan have higher solubility, lower crystallinity, degree of deacytilation, particle size, formation of particle and agregation (Tiyaaboonchai, 2003).

Application of chitosan exhibits the promising to removing of organic ang inorganic polutant like dyes, phenol and heavy metal (Bhatnagar *et al.*, 2009], Pb dan Pt (Kondo, *et al.*, 2015), Fe(II) and Mn(II) (Ali *et al.*, 2018). The removing capacity is due to the presence of functional group that can form to coordination bonds (Kondo, *et al.*, 2015). The properties of chitosan exhibits biodegradle, non-toxic, biocompatible and can be resized in nano-size. Modification of chitosan into chitosan nanoparticle with a crosslinker can expands its usefulness as drug delivery (Kavaz, 2010). organ transplants and restoring organ function (Kumar and Koh 2012) and efficient sorption of heavy metal (Holban *et al.*, 2016).

Synthesis of chitosan nanoparticle have five methods are presently available are ionic gelation method, microemulsion, emulsifcation solvent diffusion, polyelectrolyte complex and reverse micellarmethod (Tiyaboonchai, 2003). The most widely used method is ionic gelation method. This method utilizes the electrostatic interaction between the amine group of chitosan and a negatively charged group of polyanion such as tripolyphosphate (TPP) (Bhumkar and Pokharkar, 2006). The TPP is a type of harmless anionic crosslinker and can interact by inter- and intramolecular with chitosan to provide better spherical morphology, increase the fexibility of the polymer increase its stability (Koiparambil and Shanavas, 2017).

In this work, isolation of chitin from Clam shells (*Cerithidea obtusa,) and tranformed into chi. , chitosan-TPP* was prepared using gelation method and characterized by functional group using FT-IR, crystal structure using XRD, and morphological surface using SEM. The effect of pH to application sorption on Chi-TPP.

Materials and Methods

Materials

Clam Shells (*Cerithidea obtusa)* was collected from beach Pondong Paser, Analytical grade NaOH, HCl, tripolyphosphate (TPP), CH_3COOH 25% and Cadmium.

Preparation of chitin and chitosan

Chitin from Clam Shells (*Cerithidea obtusa)* was prepared by a demineralization and deproteination. The product was transformed into chitosan by deacetylation process. The resulting of chitosan was separated, washed with distilled water to neutral pH.

Synthesis of Chi-TPP

Five grams of chi were dissolved into 25 mL CH_3COOH 1% and then 5 mL croslinker of tripolyphosphate (TPP) was added into chi solution. The mixture was shaked by magnetic stirer for 1 hour to homogeneous. After the completion of the reaction, the product of Chi-TPP was washed by deionized water to neutral.

Characterization.

The functional group of Chi-TPP was analyzed by Shimadzu 8201 PC Fourier transform spectrometer (FTIR). The crystal structure were characterized by Shimadzu X-ray diffraction (XRD) using CuKα radiation (λ = 1.5406 Å) operated at 40 kV and 30 mA). Morphological surface was examined by JEOL SSM-6510 LA Scanning electron microscopy (SEM)

The sorption of cadmium ion on Chi-TPP.

Sorption application of optimum pH was carried out by a batch adsorption method. A series of 50 $mg.L^{-1}$ cadmium ion were adjusted to pH 2; 3; 4; 5; 6; 7; 8; 9; 10; 11 by adding HCl or NaOH solutions. Interaction of cadmium solution on 20 mg of Chi-TPP by shaking for 120 minutes. After adsorbent was separated, concentration of cadmium was analyzed using AAS.

Results and Discussion

Calm shells (*Cerithidea obtusa*) were obtained from beach of Pondong Village, Paser, East Kalimantan. The size of shell is 5 cm, blackish brown color and existing is very abundant and unutilized. Isolation of chitin from Calm shells (*Cerithidea obtusa*) by a demineralization and deproteination and then was transformed into Chi by deacetylation. The Chi-TPP was synthisized by gelation method that is the complexation of Chi with TPP as a crosslinker. The form physical of Chi and Chi-TPP were the same, but coloring of Chi-TPP is more white and easily to dissolve in acetate acid solution. The form physical of Chi and Chi-TPP are shown in Fig.1.

Figure 1. material of a) Chi and b) Chi-TPP

Material of Chi-TPP was successfully complexed by the gelation method which was indicated change in the characteristics of the FTIR, XRD and SEM analysis. The FT-IR spectra of chitin, Chi, Chi-TPP are shown in Fig.2.

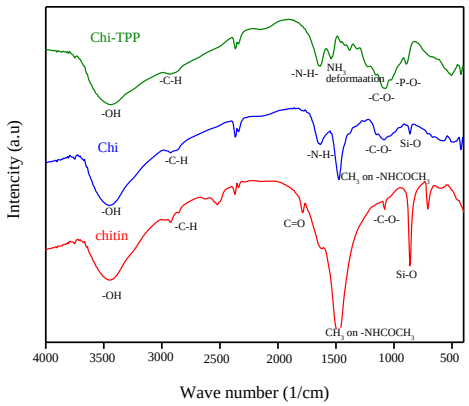

Figure 2.. FTIR Spectra of chitin, Chi and Chi-TPP

The functional group of chitin has a wavenumber at 3425 cm^{-1} due to the -OH groups. The $-CH_2$ group was showing at 2924 cm^{-1} as attributed to the symmetrical stretching, the band at 1473 cm^{-1} was $-CH_3$ group on amide ($-NHCOCH_3$), wave number at 1798 cm^{-1} due to the C=O group on amide (-NHCO) and then at 1080 cm^{-1} the stretching vibration of C-O-C in glucose circle. The impurities spectra of silica mineral on chitin at wave numbers 864, 11 cm^{-1} and 709,80 cm^{-1}. (Silverstein *et al.*, 1981).

The FTIR spectra of Chi has similar to a chitin, this has a wavenumber at 3448 cm^{-1} due to the -OH groups, $-CH_2$ group at 2931 cm^{-1}, stretching vibration of C-O-C at 1087 cm^{-1}, CH_3 group on amide ($-NHCOCH_3$) at 1473 cm^{-1}, wave number at 1798 cm^{-1} due to the C=O group on amide (-NHCO). (Silverstein dkk, 1981) and then presence of silica mineral at wave number 864 cm^{-1}. The difference FTIR spectra of chitin and Chi was loss of C=O group of amida (-NHCO-) ((Silverstein *et al.*, 1981).

Characteristic FTIR spectra of Chi-TPP has peak at 1534 cm^{-1} was assigned to deformation of -NH, the band at 1651 cm^{-1} was bending vibration of N-H group

from amine (-NH_2) (11) and vibration of P-O on TPP at 1026 cm^{-1}. The loss FTIR spectra of Chi-TPP were C=O group, CH3 group on amide (-$NHCOCH_3$) and impurities of silica mineral. (Silverstein *et al.*, 1981). The XRD pattern of Calm shells, Chi and Chi-TPP are shown in Fig.3.

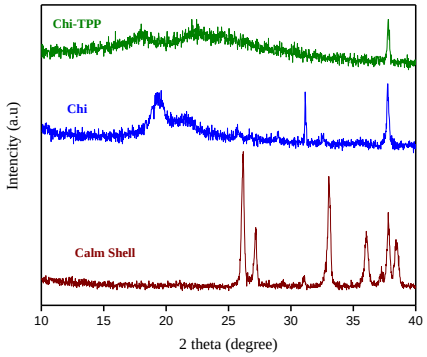

Figure 3.. XRD pattern of Clam shells, Chi and Chi-TPP (magnification 10.000x)

The difraction of Calm Shell has crystalline structure because there are still many minerals. XRD pattern of Chi has two characteristic peaks at 10,15^o and 19,94^o but still has impurities in peaks at 32o and 38^o. The characteristic XRD pattern of Chi-TPP has a broad at 19,85^o and 23.50^o. (Bhumkar dan Pokharkar, 2006). Difraction of Chi is crystallite structure, Cross-linking of TPP on Chi where these two peaks disappeared in XRD pattern of Chi-TPP, which indiates amorphous shape.

SEM image of Chi and Chi-TPP are shown in Figure 4. The morphological surface of Chi has rigid colloid-shaped and then SEM image of Chi—TPP showed threads-shaped of cross-linker TPP on chi-surface and stabilizes them.

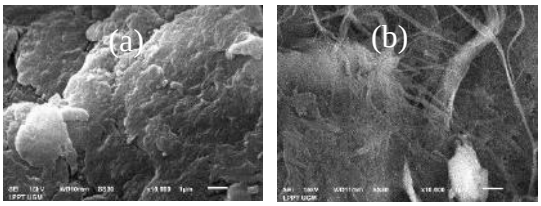

Figure 4.. SEM image of Chi and Chi-TPP

Determination of the optimum pH was carried out to determine the optimum pH conditions to adsorb cadmium ion using Chi-TPP. The effect of pH adsorption of cadmium ion on Chi-TPP are shown in Fig.5

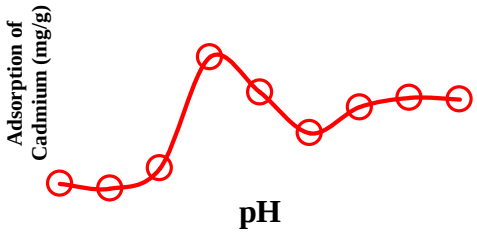

Figure 5.. The Effect of pH adsorption of cadmium ion on Chi-TPP

Based in Figure 5, pH range experiment was varied from 1.0-9.0. At low pH, ion H^+ has high concentration and compete with Cd ion for sorption. Hovewer, if pH solutions was increased, the sorption of Cd was increased because concentration of ion H^+ due to decreased. Optimum pH for sorption of Cd ion on Chi-TPP at pH 4.0 Increasing the pH futher was resulted in a decreased for sorption until at pH 7. At pH 8 -9, the sorption of cadmium ion was increased because cd ion has was started to precipitate (Seyedi *et al.*, 2013)

Conclusions

The succesfull isolation of chitin from Clam Shells (*Cerithidea obtusa)* and synthesis of Chi-TPP from chitin. XRD pattern of Chi-TPP has characteristic peak is amorphous shape. SEM image of Chi-TPP is rigid-colloid with cross-linking of TPP. Optimum pH Adsorption of cadmium ion on Chi-TPP at pH 4.

Acknowledgements

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Synthesis of Silver Nanoparticle Using Bioreductor Method from Cempedak (Artocarpus integrifolius l. f) Bark Extract

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Abstract

Synthesis of silver nanoparticle using bioreductor method from cempedak (Artocarpus integrifolius L. f) bark extract has been conducted. Steps in this research performed with synthesis of silver nanoparticle using $AgNO_3$ solution with variation of concentration reacted with bioreductor in form of Cempedak (Artocarpus integrifolius L. f) bark extract, then characterized with Spectrophotometer UV-Vis, TEM (Transmission Electron Microscope) and PSA (Particle Size Analyzer). Results of maximum wave length measurements with Spectrophotometer UV-Vis shows the most stable silver nanoparticle is with $AgNO_3$ 0,004 M concentration. TEM analysis results shows silver nanoparticle morphology as rounded and varies in size and shows average particle size in nanoparticle using bioreductor is 78,66 nm. PSA result analysis obtained particle size distribution in nanoparticle using bioreductor from 50-170 nm shows that nanoparticles has formed.

Keywords: *Silver Nanoparticle, bioreductor, cempedak (Artocarpus integrifolius L. f), stability*

Introduction

Nanotechnology is an aspect of biology, physics, chemistry and engineering which is interesting and also important today and in the future. One kind of nanotechnology greatly developed today is nanoparticle. Nanoparticle that mostly used is metal nanoparticle due to its wide application. One mostly used metals is silver (Ag). Among available methods, the most effective method to produce silver nanoparticle is reduction method. This method has fast, convenient, low-cost also utilizing low temperature (Khaydaroy *et al*., 2009). In reduction method, bioreductor can be used.

Reduction method done in this silver nanoparticle synthesis by utilizing bioreductor. Bioreductor used in silver nanoparticle synthesis is betel leaf extract (*Piper betle* linn), where in said betel leaf extract contains secondary metabolite which can reduct silver in silver nanoparticle synthesis (Purnamasari, 2015). In this research utilizes cempedak bark extract (*Artocarpus integrifilous* L. f). Cempedak bark chosen due to expectation in containing secondary metabolite which is not only found in leaf, branch, and root but also diffused in barks.
Research Methodology

Materials and Methods

Materials

Material in this research including $AgNO_3$ solution, aquadest, methanol 99,9%, cempedak bark (*Artocarpus integrifolius* L. f).

Research Procedure

Cempedak bark sample preparation

Cempedak bark taken from cempedak tree in Handil, Muara Jawa, Kutai Kartanegara. Cempedak bark dried with room temperature, then cut into small pieces with size of 0,5-1 cm.

Sample Extraction

Extraction method of cempedak bark extract bioreductor in the research reffering to Lestari *et al.*, (2016) using maceration and evaporation. Cempedak bark powder as much as 1 kg macerated with methanol for 3 x 24 hours. Later, obtained methanol extract concentrated with evaporator until thick methanol extract obtained.

Alkaloid Test

Crude extract of cempedak bark put in test tube, then added 2 drops of Dragendroff reagen (mixture of $Bi(NO_3)_2.5H_2O$ in nitric acid and Kl solution). Positive

result of alkaloid test marked by formed sediments with orange to brownish red color (Sitorus, 2010).

Steroid and Triterpenoid Test

Crude extract of cempedak bark put in test tube, then added 3 drops of Liebermann-Burchard reagen (mixture of acetic acid anhydrate and $H_2SO_{4(p)}$). Positive result of steroid and triterpenoid test marked by color shift of sample into red or purple (Harborne, 1987).

Flavonoid Test

Crude extract of cempedak bark put in test tube, then dissolved with corresponding solvent. Added 2 mg of Mg powder and 3 drops of $HCl_{(p)}$. Positive result of flavonoid tes marked by color shift of sample into red, yellow, or orange (Harborne, 1987).

Phenolic Test

Crude extract of cempedak bark put in test tube, then dissolved with corresponding solvent. $FeCl_3$ 1% solution added. Positive result of phenolic test marked with color shift of sample into red, green, black, blue, or strong purple (Harborne, 1987).

Saponins Test

Crude extract of cempedak bark put in test tube, then dissolved with 2 mL aquadest and shaken until foams formed. Added 2-3 drops of $HCl_{(p)}$ solution. Positive result of saponins test marked by formed foam with 1-3 cm height that lasts ±15 minutes (Harborne, 1987).

Synthesis of silver nanoparticle with bioreductor from extract of cempedak bark (*Artocarpus integrifolius* L. f)

Extract of cempedak bark taken as much as 5 mL and mixed in $AgNO_3$ as much as 45 mL with concentration vary from 1,5 x 10^{-3}, 2 x 10^{-3}, 3 x 10^{-3} and 4 x 10^{-3} M. solution synthetized into *microwave* with 60˚C temperature until the color shift occur into brownish yellow indicating nanoparticle formed. (Kudle *et al.*, 2014).

Stability analysis of nanoparticle with spectrophotometer *UV-Vis*.

Characterization of silver nanoparticle formed carried out with spectrophotometer UV-Vis instrument. This characterization aim to find out formed silver nanoparticle and its stability.

Analysis with *Transmission Electron Microscope* (TEM)

Characterization of silver nanoparticle with TEM (Transmission Electron Microscope) aim to understand the morphology of silver nanoparticle synthesis result showed in picture.

Analysis with PSA (Particle Size Analyzer)

Characterization with PSA (Particle Size Analyzer) on silver nanoparticle sample aim to determine the size of nanoparticle.

Results and Discussion

Synthesis of silver nanoparticle with bioreductor

Synthesis of silver nanoparticle with bioreductor carried out with utilizing cempedak bark extract, where extraction of dried cempedak bark extract as much as 1 kg with maceration method using organic solution which is methanol. Extraction process with organic solution done to pull out secondary metabolite compound contained in cempedak bark. Result obtained in form of methanol extract of 202,2 g cempedak bark with 20,22 % yield percentage result. After methanol extract of cempedak bark obtained, phytochemicals test carried out qualitatively. Result from phytochemicals test of methanol extract of cempedak bark showed in table 1.

Table 1. Result of phytochemical test of ethanol extract of cempedak bark

No.	Secondary Metabolite	Test Result
1.	Alkaloid	-
2.	Flavonoid	+
3.	Phenolic	+
4.	Quinone	-
5.	Steroid	-
6.	Triterpenoid	+
7.	Saponin	-

Annotation:
(+) = Positive containing secondary metabolite compound.
(-) = Negative containing secondary metabolite compound.

According to phytochemical test, positive test result obtained in secondary metabolite compound flavonoid, phenolic and triterpenoid. Therefore, cempedak bark extract can be utilized as bioreductor in synthesis of silver nanoparticle with bioreductor. Based on research done by Purnamasari (2015), it is discovered that every plants contain various kinds of secondary metabolite which has groups of phenolic

compound. Phenolic compound has high nucleophilic, hence able to reduce metal.

Synthesis process of silver nanoparticle with bioreductor carried out by means of micro wave from *microwave* with temperature of 60˚. In this synthesis process of silver nanoparticle with bioreductor, cempedak bark extract will reduce silver ion in $AgNO_3$ from Ag^+ into Ag^0, hence formed a solution with yellow brownish color as shown in Figure 1, marking the forming of nanoparticle.

Figure 1. Synthesis result of silver nanoparticle with bioreductor (cempedak bark extract) with concentration level of $AgNO_3$ 0,0015; 0,002; 0,003; 0,004 M.

Synthesis result of silver nanoparticle with bioreductor (cempedak bark extract) is in shape of solution with yellow brownish color, where the higher the level of concentration of $AgNO_3$ used, the thicker the color of the solution, whereas nanoparticle obtained with lower concentration level of $AgNO_3$ produce lighter color solution. It is proven in result test of spectrophotometer UV-Vis, where in synthesis result of silver nanoparticle with bioreductor, maximum wave length measurement applied in each silver nanoparticle with variation of concentration levels and a chart obtained showed Figure 2.

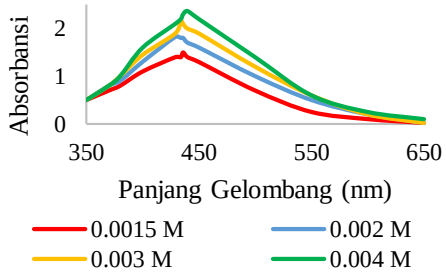
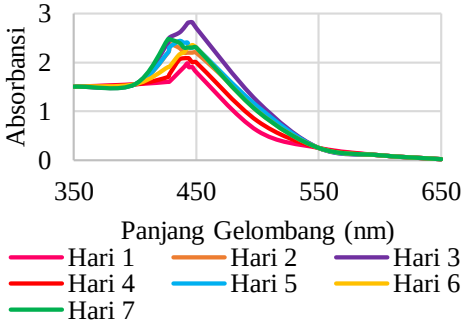
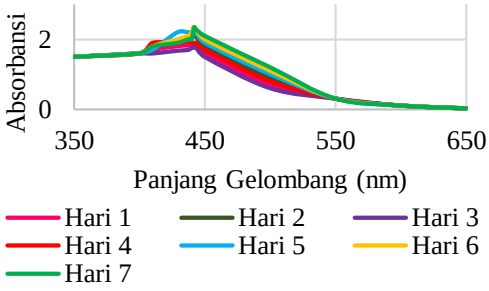


Figure 2 Result of maximum wavelength measurement on silver nanoparticle with bioreductor.

Analysis of Silver nanoparticle stability with Spectrophotometer *UV-Vis*



(a)



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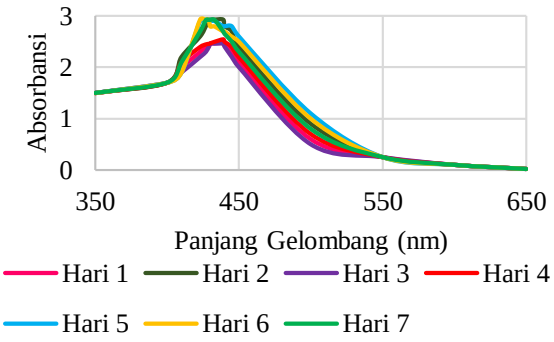

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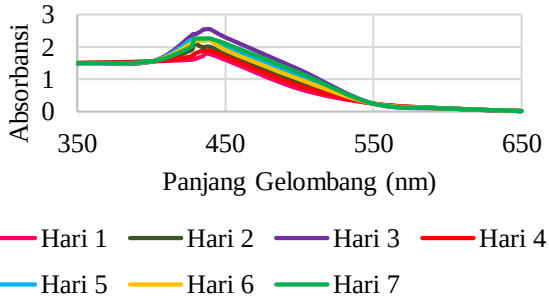


(d)

Figure 3 Observation result of silver Nanoparticle with bioreductor stability for 7 days (a) $AgNO_3$ 0,0015 M, (b) $AgNO_3$ 0,002 M, (c) $AgNO_3$ 0,003 M and (d) $AgNO_3$ 0,004 M.

Stability data of silver nanoparticle with bioreductor can be viewed with wave length measurement method with Spectrophotometer *UV-Vis*, where in range of 400-450 nm denote the unique properties of silver nanoparticle formed (Solomon *et al.*, 2007). Nanoparticle formed measured its maximum wavelength for 7 days to perceive the stability of the nanoparticle. Maximum wave length measurement result on silver nanoparticle with bioreductor done for 7 days can be viewed from spectrophotometer *UV-Vis* measurement result shown in Figure 3.

Measurement result of silver nanoparticle with bioreductor stability for 7 days using spectrophotometer *UV-Vis* showed nanoparticles in each concentration stable. Research result shows wave length shifting in silver nanoparticle with $AgNO_3$ 0,0015 M concentration approximately 428-447; in 0,002 M approximately 429-443; in 0,003 M approximately 423-440 and in 0,004 M approximately 428-440 nm. Based on said wave length measurement result, silver nanoparticle with $AgNO_3$ 0,004 M concentration level is more stable than the silver nanoparticle with $AgNO_3$ 0,0015 M, 0,002 M and 0,003 M concentration level due to silver nanoparticle with $AgNO_3$ 0,004 M concentration level has the smallest deviation in wave length shifting than other $AgNO_3$ concentration. As for maximum wave length measurement for 7 days result on silver nanoparticle with bioreductor using various concentration level of $AgNO_3$ can be viewed in Figure 4.

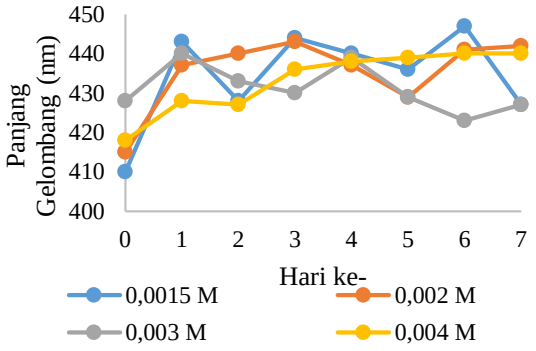
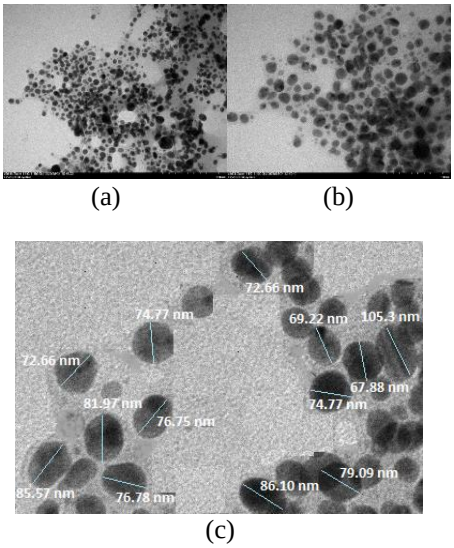


Figure 4 Result of maximum wavelength measurement on silver nanoparticle with bioreductor for 7 days.

Based on result of maximum wave length measurement for 7 days, shows that wave length shifting occur in nanoparticle with various $AgNO_3$ concentration level. This maximum wave length position shifting showed that changes occur in size of nanoparticle from each concentration. From obtained data, for silver nanoparticle with bioreductor has stability on silver nanoparticle with $AgNO_3$ 0,004 M due to insignificant wave length shifting in deviation than in other concentration levels of $AgNO_3$. According to Ridwan *et al.*, (2019), storing length also affecting silver nanoparticle absorbance due to silver nanoparticle forming in process, where reduction process of Ag^+ into Ag^0 still occur.

TEM (Transmission Electron Microscope) analysis

Based on result test of silver nanoparticle with bioreductor stability using spectrophotometer *UV-Vis*, silver nanoparticle with $AgNO_3$ 0,004 M concentration level characterized using TEM (Transmission Electron Microscope). The aim of characterization with TEM is to understand the morphology and average particle size based on diameter measurement using ImageJ software, also to ensure that silver nanoparticle formed by diffraction picture made. Characterization result of silver nanoparticle with bioreductor using TEM can be viewed in Figure 5.



(a) (b)

(c)

Figure 5. *Transmission Electron Microscope* (TEM) characterization result on silver nanoparticle with bioreductor (a) 200 nm scale (b) 100 nm scale (c) Size of silver nanoparticle with bioreductor.

Based on characterization result of silver nanoparticle with bioreductor using TEM, morphology of silver nanoparticle obtained in round shape with various particle sizes. Particle size measurement with ImageJ software, smallest particle size obtained is 67,88 nm and largest particle is 105,3 nm. Average size of particle is 78,88 nm, where in characterization with TEM the scale used is 200 and 100 nm.

PSA (Particle Size Analysis)

Silver nanoparticle with bioreductor also characterized with PSA (Particle Size Analyzer). Aim of PSA characterization is to determine the size of particle and

uniformity of particle analyzed. PSA (Particle Size Analyzer) characterization result of silver nanoparticle with bioreductor as shown in Figure 6.

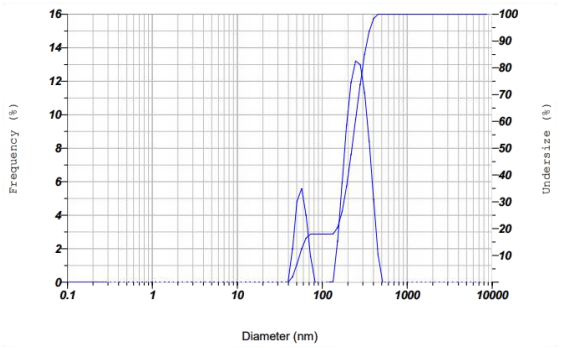


Figure 6 PSA (Particle Size Analyzer) characterization result of silver nanoparticle with bioreductor

Based on PSA characterization result of silver nanoparticle with bioreductor, size distribution of nanoparticle in range of 100 to 170 nm. Particle size obtained generally from 40 nm to 100 nm. From said data, average size of particle discovered suitable with the research done by Prasetiowati *et al.*, (2018), where particle size obtained is 112,8 nm.

Conclusions

Silver nanoparticles produced by bioreductor shows stability for 7 days on $AgNO_3$ with 0,004 M concentration level. Morphology of nanoparticles are round in shape and average size of nanoparticle with bioreductor is 78,88 nm. While according to PSA data, distribution of particle size on nanoparticle with bioreductor in range of 50-170 nm.

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Estimation of Shrimp Stocks Caught at Night in the Samboja Kuala Coastal waters of Kutai Kartanegara Regency

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Abstract

Samboja Kuala is contribution area for fisheries production for Samboja District, with the dominant catch being shrimp. The fishing gear used by Samboja Kuala fishermen to catch shrimp is trawl and trammel net. Shrimp fishing activities with trawl are done every day by the fisherman of Samboja Kuala, even though the catches obtained are always there. The purpose of this research was to determine the estimated stock density and shrimp biomass with shrimp distribution in the Samboja Kuala Coastal Waters. The study was conducted from November to December 2019 using fishing boats operating trawl in the Samboja Kuala Coastal Waters. The density of shrimp stock and biomass was estimated by the swept area method. The results of this study showed that shrimp caught at night consisted of 7 species of shrimp and the dominant species found was Pink Shrimp (Metapenaeus affinis) of 58.6%. Horizontally, the highest shrimp distribution was found at station 2 and station 4. The average stock density is 233,74 kg/km^2. Estimated shrimp biomass in the northern zone of Samboja Kuala waters during the study was 8,007.10 kg or 8 tons.

Keywords: *Estimation of Shrimp Stocks, Shrimp Biomass, Samboja Kuala*

Introduction

Samboja is one of several sub-districts located in Kutai Kartanegara Regency. On the left, the Samboja Region borders the Makassar Strait (BPS Kutai Kartanegara, 2019), this makes Samboja an area with large and diverse fishery potential. Fishery activities are the activities of the Samboja people, whose contribution is quite large to the economy of Samboja District and Kutai Kartanegara District. Fishery activities in Samboja consist of capture fisheries and aquaculture, where fisheries products are dominated by capture fisheries.

Samboja Kuala is one of several sub-districts located on the coast of Samboja District, and is a significant contributor to fishery production for Samboja District with the dominant catch being shrimp. The fishing gear that is often used by fishermen of Samboja Kuala to catch shrimp is *trawl*. Shrimp catching activities by *trawl* is carried out every day by Samboja Kuala fishermen, which in a day fishermen can make two trips, namely during the day and at night, and there are differences in the species of shrimp caught during the day and night.

Based on this, it is necessary to conduct research on the condition of stock density, biomass and distribution of shrimp in the waters of Samboja Kuala where the fishermen operate the trawl. This research focuses on fishing activity at night, and data analysis uses the swept area method. This study aims to determine and analyze the estimated stock density and biomass of shrimp caught in the coastal waters of Samboja Kuala at night and to determine the distribution of shrimp in the Samboja Kuala Coastal Waters.

Methods and Materials

Time and Location of Research

The research was carried out from November to December 2019 in Samboja Kuala Coastal Waters, Samboja District, Kutai Kartanegara Regency by participating in shrimp trawling activities at night. The location of data collection during the study was in the North Zone of Samboja Kuala Coastal Waters.

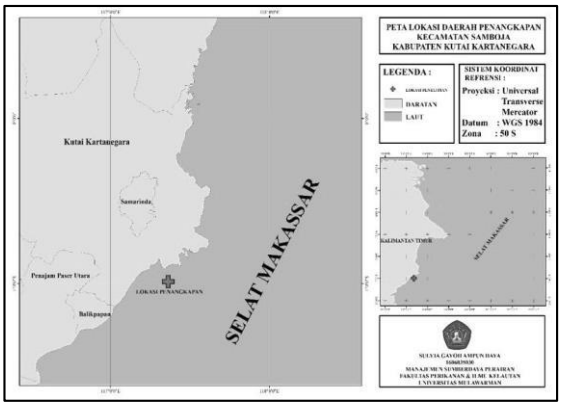

Figure 1. Map of Research Location

The tools used during the research were ships, trawlers, scales, GPS and stationery. Then the materials used in the study were shrimp caught from the trawl.

Research Procedure

In this study, the data used consisted of primary data and secondary data. Primary data used in the study were obtained through surveys and interviews. The survey activity was carried out by following a fishing boat that operates a shrimp trawl at night. The data taken during the survey are the type of shrimp caught, the number of shrimps caught (kg), the time of towing the trawl (hours), the speed of the trawl (km / hour), the length of the upper rope (km) and the coordinates of the fishing area. The data is observed for each hauling. conducted on shrimp collectors and some fishermen in Samboja Kuala who operate shrimp trawls at night. Meanwhile, secondary data were obtained from literature studies.

Data Analysis

Primary data obtained from the swept area survey, then analyzed. The swept area method is used to estimate the total biomass in a fishing ground. The calculation of stock density and shrimp biomass in a fishing area uses the following formula (Sparred an Venema, 1999 in Sandria, 2014):

a. Determination of the swept trajectory

$$D = V \times t$$

Description:
D = the sweeping trajectory (km)
V = Ship towing speed (km / h)
t = long net withdrawal (hour)

b. Determination of the swept area

$$a = D \times hr \times X_2$$

Description:
a = the area of the sweep (km^2)
D = the sweeping trajectory (km)
hr = Length of upper rope (km)
X_2 = Coefficient for opening the mouth of the net (0, 5)

c. Stock Density

d.

$$Q = \frac{Cw/a}{ef}$$

Description:
Q = Shrimp density per swept area (kg / km^2)
Cw = Shrimp catch per swept area (kg)
a = Area of sweep (km2)
ef = breakout factor (0.4)

e. Biomass at the research location

$$B = \frac{(Cw/a)*A}{X1}$$

Description:
B = estimated total biomass (kg)
Cw / a = Average catch per swept area (kg / km2)
A = Area surveyed (km2)
X1 = Constant (estimated shrimp escape at time capture) (0.5)

Results and Discussion

Trawl Operation Areas

During the research, the area of shrimp trawling activity at night was in the North Zone of the coastal waters of Samboja Kuala, precisely close to the Mahakam Delta area. The depth of the waters where fishermen operate the trawl ranges from ± 20-25 meters and the bottom of the water is mud-substrate. During the research, the trawl operation was carried out 5 times. The following is a map of the coordinates of the trawl operation for 5 trips, it can be seen in Figure 2.

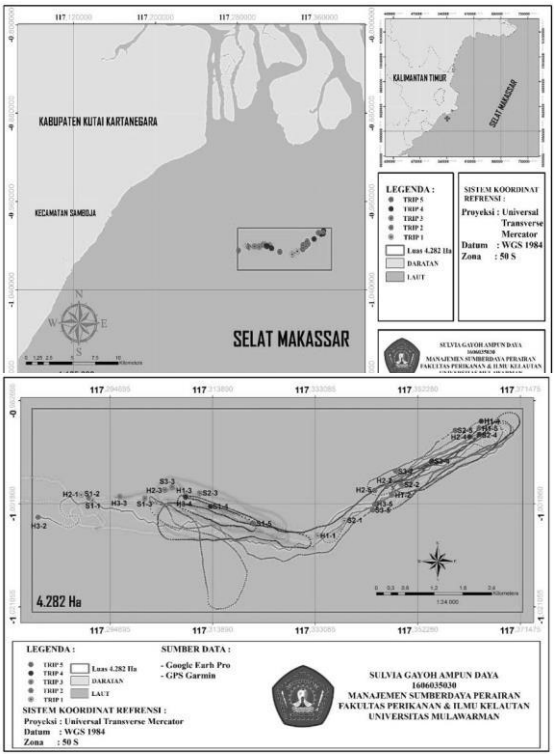

Figure 2. The coordinate point of the trawl operation during the research

The research was carried out for 5 trips with a total setting and hauling carried out 14 times. During the research, there were 14 fishing stations scattered in the northern zone of the Samboja Kuala waters.The longest track distance (D) that is traversed by the trawl is 22.5 km at station 6 and the shortest path distance, which is 12 km at station 14. The largest area that the trawl passes during the study is 0.191 km^2 at station 6 and the area the smallest area at station 3 is 0.081 km^2.

Composition of Catch

There are several types of night prawns obtained during the study, including the Tiger Shrimp, White Shrimp, Pink Shrimp and Spot Shrimp. Based on the identification results of the four types of shrimp, the results showed that there were seven species of shrimp, from four shrimp genera of the Penaeidae family, namely two species from the genera Penaeus, two species from the genera Metapenaeopsis, two species from the genera Metapenaeus and one species from the genera Solenocera. . The seven species of shrimp are *Penaeus monodon*, *Penaeus merguiensis*, *Metapenaeopsis barbata, Metapenaeopsis palmensis, Metapenaeus affinis, Metapenaeus monoceros* and *Solenocera crassicornis.*

The composition of the catch of the seven species during the study were *Penaeus monodon* 5.87%, *Penaeus merguiensis* 14.6%, *Metapenaeopsis* barbata 5.58%, *Metapenaeopsis palmensis* 9.36%, *Metapenaeus affinis* 58.6%, *Metapenaeus monoceros* 2.06% and *Solenocera crassicornis* 3.92%. During the research, the dominant shrimp caught was Pink Shrimp species (*Metapenaeus affinis*) with an average percentage of all fishing stations of 59.04%. Meanwhile, the shrimp species that catch a littleor not dominant during the study was the Spotted Shrimp (*Metapenaeus monoceros*) with an average percentage of all fishing stations of 2.12%.

There are several factors that can influence the presence of certain dominant species of shrimp caught, including the condition of the shrimp catching area, such as the depth and substrate of the waters which are the habitat of the shrimp species, and the shrimp spawning season. According to the research conducted by Saputra, et al. (2013) in Cilacap waters, Dogol Shrimp (*Metapenaeus affinis*) is predominantly caught in November - December. Then based on the research of Tirtadanu, et al. (2017) in the waters of Kotabaru-South Kalimantan, it is known that the spawning season for *Metapenaeus affinis* takes place throughout the year with a peak in March. While the *Metapenaeus monoceros* Shrimp spawning season takes place between March - October (Liao and Huang, 1970 in Saputra, et al., 2013).

Shrimp Stock Density and Biomass

The catch obtained during the study was analyzed for know the density of shrimp stock at each fishing station. The following is data on the density of shrimp stocks at each fishing station, it can be seen in Table 1.

Table 1. Shrimp stock density at each fishing station

Trip to-	Station	Stock density (kg / km^2)
1	1	178.57
	2	357.14
2	3	308.64
	4	396.83
	5	267.20
3	6	156.86
	7	184.87
	8	196.08
4	9	224.09
	10	204.79
	11	163.40
5	12	252.10
	13	157.56
	14	224.26
Average		**233.74**

In Table 1 above, it can be seen that the highest stock density is obtained at station 4 (0 ° 59'53.7 "- 0 ° 59'55.0" S and 117 ° 20'57.1 "- 117 ° 20'47.2" E) which is 396.83 kg / km^2, while the lowest stock density is at station 6 (1 ° 00'03.0 "- 1 ° 00'01.3" S and 117 ° 18'04.4 "- 117 ° 18'31.8" E) amounting to 156.86 kg / km^2. The density of shrimp stocks obtained at each station is (spatially) different, this can be caused by differences in environmental conditions at each station such as the content of organic matter and aquatic substrate (Tirtadanu et al., 2018). If the content of organic matter in the waters is high and the mud substrate is dominant at the fishing station, the density of the stock obtained is high, because in these conditions it is a suitable habitat for shrimp (Tirtadanu et al., 2018).

In this study, the average stock density of 14 stations was 233.74 kg / km^2. The average stock density is higher than the average density of shrimp stocks in the waters of East Kalimantan, which is 16.5 kg / km^2, with the highest stock density found in the waters of East Balikpapan at 79.2 kg / km^2 (Tirtadanu et al., 2018). This is thought to be due to the condition of the waters at the research location being shallower than in other locations of the East Kalimantan waters. The location during this research is also in the waters of East Kalimantan, which is directly adjacent to the Makassar Strait, the waters of the Makassar Strait are mostly deep sea waters (Tirtadanu et al., 2018) so the possibility of stock density obtained in the waters of East Kalimantan is low.

Based on research conducted at 14 stations spread across the northern zone of the Samboja Kuala waters, the surveyed area was 42.82 km2, with an average catch per sweeping area during 5 trips, namely 93.50 kg / km2. Based on the value obtained, the estimation of shrimp biomass in the fishing station area is 8,007.10 kg or about 8 tons. The estimation of shrimp

biomass obtained is to state the stock / stock of shrimp contained in a certain area during the study (Budiman, 2006). According to Gulland (1985) in Adnyana (1992), the value of biomass obtained in a certain area is closely related to the ability to produce per year.

Conclusions

Based on the research results obtained in the northern zone of Samboja Kuala waters during the study, it can be concluded that several points are as follows:

a. In the night trawl operation, the average spatial density of shrimp stock was 233.74 kg/km^2 and the estimated value of shrimp biomass was 8,007.10 kg or about 8 tons with the surveyed area of 42.82 km^2.
b. In this study it is known that there are seven species of shrimp that are commonly caught in the northern zone of Samboja Kuala waters. The seven species were evenly distributed at all fishing stations during the study, with the highest number of shrimp catches being found at station 2 and station 4.

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Distribution of *Escherichia coli* in Miang Besar Island, Sangkulirang Districs, East Kutai

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Abstract

Escherichia coli is a fecal Coliform that originates from the intestines of humans and warm-blooded animals. E. coli bacteria can be found in nature and also seawaters. In nature, they have an important rule to degrade organic material and can also be an indicator of pollution. The study aims to determine the distribution of E. coli bacteria and water quality of marine ecosystems. Sampling was conducted from January to March 2020 in Miang Besar Island. Sampling was carried out at 4 stations that represent coral reef, seagrass, and mangrove ecosystems as well as community settlements. The research method used is MPN (Most Probable Number) method for laboratory testing and data analyzed by descriptive qualitative. MPN test results indicate that there are E. coli bacteria in the seawater of Miang Besar Island on average in the seagrass ecosystem 11 MPN / ml, in the community settlement 9 MPN / ml and mangrove ecosystem 2 MPN / ml, respectively. Based on KEPMEN-LH Number 51 of 2004 that the presence of E. coli bacteria according to seawater quality standards.

Keywords: *Escherichia coli Bacteria, Miang Besar Island, MPN Method*

Introduction

Escherichia coli bacteria was found in 1885 with Theodore Escherich. *Escherichia coli* is a faecal *Coliform* that comes from the intestines of humans and warm-blooded animals. *Escherichia coli* bacteria can be found in nature, generally in waters. In nature, bacteria can degrade organic matter but the main role of *E. coli* in the marine ecosystem is as a bioindicator of pollution in the sea. If the abundance of *E. coli* is high, it can affect the bacteriological activity in the three ecosystems. *E. coli* bacteria help to degrade complex organic compounds containing elements of C, H, and N in the ecosystem (Parwanayoni, 2008).

Pulau Miang Besar, which is the only village established since 2005, is located outside the Sangkulirang District, East Kutai Regency. The area around the waters of Miang Island also has 3 most important ecosystems in the sea it is mangrove ecosystem, seagrass ecosystem and coral reef ecosystems. Miang Besar Island utilized in the fisheries business, shipping areas, residential areas and also has tourism potential. Miang Besar Island is currently inhabited by around 555 people, with 283 men and 272 women (BPS Kabupaten Kutai Timur, 2019).

The study aims to determine the distribution of *E. coli* bacteria and water quality of marine ecosystems This research is expected to be a data base and useful for further research. where in Miang Island it is still very rarely used as a research location.

Methods and Materils

Location and Time of Research

The sampling location was conducted in the waters of Miang Besar Island, Sangkulirang District, East Kutai Regency. Sample processing was carried out at Aquatic Microbiology laboratory and Water Quality Laboratory of the Faculty of Fisheries and Marine Sciences, Mulawarman University. This research was conducted on January until March, 2020.

Figure 1. Map of the Research Location

The tools used in this research are test tubes, durham tubes, measuring cups, pipettes, spatulas, analytical scales, Hot Plate, Bunsen, Warp plastic or aluminum foil, autoclave, sterile bottles, ose needles, cool box, vortex, erlenmayer, sterile spoons.

The materials used in this research are seawater samples, *Lauryl Tryptose Broth* (LTB), *Brilliant Green Lactose Broth* (BGLB), *Escherichia coli* Broth (EC Broth), NaCl (0.9%), Aquades, tissue and Ice Blue pack, *Safranin, Iodine,* and *Cristal Violet*.

Sampling in this study was carried out by inserting a sterile sample bottle into water 10 cm below sea level to take water samples. Water samples were taken 3 times repetition. At the time of taking water the sample bottle was tilted 45^0, after the bottle was filled closed and lifted to the surface then labeled and put into a cool box filled with ice and ice blue pack.

Furthermore, at each sampling station, measurements of water quality parameters such as temperature, salinity, pH, DO, and environmental anomalous characteristics are carried out in the form of weather and conditions around the station. The seawater sample was then tested in the laboratory with the MPN (Most Probable Number) 3 series tube method and was stained with gram then observed under a microscope.
Data analysis

Analysis of the results of this study was carried out after obtaining research data. The data from the *Escherichia coli* abundance test were analyzed descriptively qualitatively and displayed in graphical form. According to Bambang et al, (2014) the data analysis method for the density of *Coliform* and *Escherichia coli* bacteria is the formula:

***Coliform* density = MPN table value x 1 / Mean dilution**

Coliform density values are determined by water conditions based on the Hopkins Table.

Results and Discussion

Research Location

Pulau Miang Besar Village is a residential area belonging to the Sangkulirang District, East Kutai Regency. Pulau Miang Village is geographically located (00^0 44' 36.67" N and 118^0 000' 47.37" E). The area of Pulau Miang Village is approximately 22.26 Km^2 and has an air temperature ranging from 18^0C-25^0C (BPS Kabupaten Kutai Timur, 2019). To this research used four station as shown in table 1.

Table 1. Coordinate of the Research Location

Location	Station	Coordinate
Coral Reef Ecosystem	I	0^0 44’ 49” N 118^0 00’ 48.9” E
Seagrass Ecosystem	II	0^0 44’ 42.7” N 118^0 00’ 53.2” E
Mangrove Ecosystem	III	0^0 44’ 42.0” N 118^0 00’ 34.9” E
Settlement of Miang Island Village	IV	0^0 44’ 34.3” N 118^0 00’ 47.5” E

Pulau Miang Besar has components of home sanitation such as clean water facilities, ownership of toilets in the form of goose neck toilets and garbage disposal facilities. However, Facility for Disposal of Wastewater is still lacking because the wastewater is still disposed of directly into the sea as shown in Figure 2.

Figure 2. Community Settlements

Water Quality Parameters

Measurement of water quality parameters aims to determine the water quality factors that affect the life of bacteria, especially *Escherichia coli* bacteria in the waters of Miang Besar Island. Parameter measurements were carried out simultaneously with sampling carried out on January 24, 2020. Data and sampling were collected from 15.00 to 17.30 WITA.

Taking parameters related to *Escherichia coli* consisted of temperature, salinity, pH and DO (Dissolved Oxygen). According to Herd et al, (2001) in Aris (2016) the temperature and salinity that can support growth for *Escherichia coli* bacteria is 12-45^0C and not greater than 85‰. Based on the microbial group also, *Escherichia coli* bacteria are included in the neurophil group, namely microbes that can grow in the pH range 5.5-8.0 (Hidayat, 2006). *Escherichia coli* bacteria are facultative anaerobic bacteria that can live without oxygen or oxygen, so DO does not affect it. DO plays a very important role in water quality indicators because in aerobic conditions oxygen can oxidize organic and inorganic materials, the result is nutrients which can provide fertility in the waters, while in anaerobic conditions oxygen can reduce chemical compounds to become simpler in the form of nutrients and gases (Salmin, 2005). DO comes from photosynthesis in the waters. The result of quality control in Miang Besar Island as shown in table 2.

Based on KEPMEN LH Number 51 of 2004 the quality standard for the conditions of marine life sets the temperature is 28-30^0 C, especially in coral reef ecosystems, mangroves and seagrass. Salinity is set at 33-34‰ in coral reef ecosystems and seagrass while mangroves range from no salinity to 34‰. The quality standard for pH is 7 - 8.5 and DO is> 5 mg / L.

The distribution of *Escherichia coli* bacteria in sea water

Table 2. Result of quality control

Quality Control of seawater				
Station	**pH**	**Salinity (‰)**	**Temp.(^{O}C)**	**DO**
I	8.02	6.72	29	34
II	8.04	6.72	29	35
III	7.99	6	29	35
IV	7.94	5.84	29	33

The testing phase of the MPN method was carried out with 3 phase, namely the prediction test then the confirmation test and last is the reinforcement test. The results of the prediction test on water obtained positive results for bacteria at stations I, II, III and IV. However, station I not found bacteria in the water sample test results. According to Sutiknowati (2016), stations that are far from the mainland generally have very small or even zero concentrations of *Coliform* bacteria, while some stations that are close to the mainland have *Coliform* bacteria found even though in small numbers. The result of the prediction test is then continued in the confirmation test.

Confirmation test to ensure positive test results are *Coliform* bacteria. The results of the confirmation test were continued with the reinforcement test to obtain *Escherichia coli* bacteria in a tube that was previously positive for *Coliform* bacteria. The final result can inform the presence of *Escherichia coli* bacteria. The results of the average existance of bacteria in seawater are presented in the form of a histogram Figure 2.

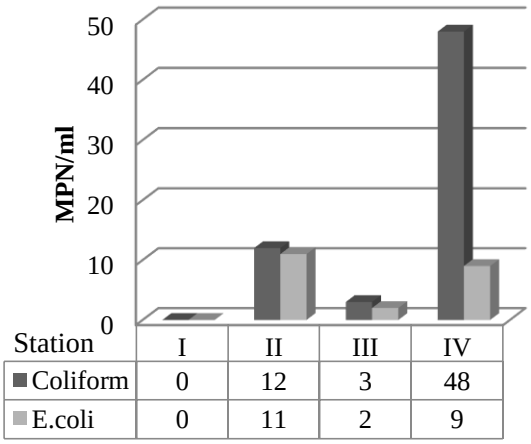

Figure 2. Histograms of Bacteria in Seawater

The existence of *Coliform* bacteria is mostly found in Station IV, which is in the community settlement of the Miang Besar Island, with an average of 48 MPN / ml and the existence of *Escherichia coli* bacteria is mostly found in Station II which is in the seagrass ecosystem with an average of 11 MPN / ml. At station II it is very easily affected by the existence of *Escherichia coli* bacteria. This is because the seagrass ecosystem is in shallow waters and can receive various sources of flow. Seagrass ecosystem also acts as the highest primary producer in shallow seas compared to other ecosystems (Thayer et al, 1975).

The spread of bacteria can spread more rapidly throughout the ocean waters due to the influence of tides and the movement of currents in the sea. According to Darmono (2001) the sea has accommodated materials carried by water from agricultural areas, household waste, garbage and waste from ships, offshore oil spills and many more materials that are wasted into the sea.

Based on the Decree of the State Minister for the Environment Number 51 of 2004 concerning Sea Water Quality Standards, that the seawater quality standard for port waters requires *Coliform* bacteria, namely <1000 MPN / ml. In marine tourism activities, the quality standards that must be met for coli are <200 MPN / 100 ml and for *Coliform* <1000 MPN / ml on biological parameters. Meanwhile, seawater quality standards for marine biota are faecal coli bacteria <200 MPN / 100 ml, *Coliform* bacteria <1000 MPN / ml. Acording to Minister for the Environment Number 51 of 2004 meaning in the four stations is still relatively safe from *Coliform* and *Escherichia coli* bacteria.

The Distribution of *Escherichia coli* bacteria in water due to factors that affect sea water such as salinity, pH, temperature and sunlight. The influence of the movement of sea water masses can occur due to currents, waves, tides and depth. This movement of sea water carries the bacteria moving and spreading according to its natural process. According to Romimohtarto (2001) the movement of seawater is very important for various natural processes of the sea, be it biological or non-biological, this movement of water is known as wave flow, water mass surface (upwelling).

Conclusions

ResultThe MPN test from this study shows that there are *Escherichia coli* bacteria in the waters of Miang Besar Island based on laboratory tests. The results obtained on average 11 MPN / ml seagrass ecosystems, 2 MPN / ml mangrove ecosystems and 9 MPN / ml settlements of Eschericia coli bacteria in the water and not found in coral reef ecosystems. Based on KEPMEN-LH No. 51 of 2004 for marine life, the presence of *Escherichia coli* bacteria in the waters of Miang Besar Island is within the threshold of quality standards.

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Sustainable City Identity in The New Capital City of Indonesia: Challenges and Opportunities

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Abstract

City as an integrated system has an important role in shaping the lifestyle and identity of its residents. In the contrary, city dwellers have the opposite role to shape the identity and elements of the city itself. The identity of cities in various parts of the world is under a lot of pressure with high levels of urbanization, population growth, and the impact of globalization. Indonesia, with the discourse of relocating the capital to Kalimantan island, which is considered as the most strategic location, can certainly have two impacts for the identity of the national's capital in the future, in the form of challenges and opportunities. Given the importance of city identity and sense of place, this paper uses the literature review method to analyze the challenges and opportunities for the identity of the new capital. The awareness about the importance in maintaining city identity can become a reference in the development of the new capital city of Indonesia, which will later become a place containing heterogeneous cultures. The challenges and opportunities that arise as a result of the discourse on relocating the capital are also expected to be considered in the formation of a sustainable capital city identity.

Keywords: *city identity, sustainability, sense of place*

Introduction

Cities as part of location units that are spread throughout the world are the carriers for many components that form local territorial identity. A city with all its constituent elements has unique characteristics and is different from cities in other regions. The formation of the city itself is influenced by many factors and causes the formation of a very complex city. Cities can form a sense of place for residents and visitors. Hay argues that the sense of place is a differentiator that forms attachment to a place, especially in geographical and social contexts in building bonds and sensing the place [1]. In addition, at a higher level, cities are also able to form a sense of belonging that is felt by people who have a special relationship with the city. This sense of place or sense of belonging is formed by the influence of identity and the components that make up the city's identity.

Studies related to city identity and sense of place have been carried out with various approaches in various locations in the world. Sense of place and city identity can also be seen from various perspectives. From the perspective of the community, identity can be built culturally, which means that the community has a contribution to the formation of the identity of a place and there is a specificity that attach them to that place [2]. Identification of urban identity is closely related to one's relationship to the spatial environment which has meanings, also complex and subjective experiences [3]. Urban identity and its environment contain symbols as a result concepts of social, emotional and even action. An approach to a sense of place using an environmental perspective is also important because of the relationship between place and its natural environment. Some elements that form a sense of place that are considered from an environmental perspective include: natural and anthropogenic features, scale of features, response to these features, and functional and emotional forms of attachment to place. [4]. The sense of place also influences the formation of city branding. Natural landscape factors, cognitive images, to tangible and intangible factors are factors that effectively shape the identity and image of the city for city residents and visitors [5]. The role of these factors also determines the quality of city branding.

The formation of a sustainable city identity goes hand in hand with the improvement of the quality of city branding and sense of place. A city that has a strong and deep identity for its residents and visitors can also contribute to regional income, especially from the tourism sector and its influence on other areas around it. The authenticity and specificity of the assets of a location (city) are important factors that increase the excellence of the city in terms of its identity [6]. The study of cities, sustainability and identity combines the relationship between social identities which includes many elements in the city, with the sustainability of the city itself. A city with a strong and sustainable identity is influenced by the physical quality of space and the social status of its people [7]. In addition, the relationship between city-identity-sustainability is also influenced by the quality of urban areas, satisfaction, identification and perception of the community, as well as the feeling of cohesion and

harmonization [8]. In the formation of a sustainable urban identity, the influence of social and environmental conditions needs to be considered.

The state capital is an important part in shaping the image of a country, because of its central position and even becomes a "gate" for foreign countries. The identity of the national capital is able to leave an impression or sense of place, not only for its residents, but also for visitors from different regions and even countries. The discourse on relocating the capital of the Republic of Indonesia from Jakarta to Kalimantan Island makes the issue of the identity of the new capital worthy of further discussion. The relocation of the national capital to a new location is the initial stage in the formation of identity, not only the capital itself, but the identity of the Republic of Indonesia and its people as a whole. Relocating the location of the national capital and establishing its identity needs to consider the opportunities and challenges that will be faced in the future. This study using the literature review method tries to discuss the opportunities and challenges associated with the identity of the new capital, as one of the considerations to support the sustainability of city identity.

Methods and Materials

The discourse on relocating the capital city of Indonesia to the island of Kalimantan, to be precise, in the Province of East Kalimantan, has made issues related to moving the capital begin to be studied from various perspectives and approaches. The question to be answered in this study is about the challenges and opportunities of moving the capital city of the Republic of Indonesia to a new location, when viewed from the sustainability of urban identity. Therefore, this study aims to analyze and summarize various challenges and opportunities related to the identity of the country's capital that will be relocated to a new location. Using the literature review method, this study tries to find information from various sources such as scientific articles, institutional websites and other credible sources related to the topic, including information about the experiences of relocating capitals in other countries in the world. All information collected is then summarized and grouped according to the categories. So that, the results obtained related to the assessment of challenges and opportunities will become comprehensive.

Results and Discussion

Sustainability of City Identity

Sustainability is meeting the needs of the present without disturbing the ability of future generations to meet their needs. The concept of sustainability covers all aspects of human life, including economic, social and environmental aspects in a multi-scale [9]. City identity from a sustainability perspective can be interpreted as the city's ability to maintain its identity in facing various challenges so that it can be passed on to future generations. Urban sustainability which also includes city branding, image and identity has a correlation with the formation of an identifiable image of quality of life [10].

The importance of urban identity for the community makes efforts to maintain its sustainability must be continuously improved. One of the efforts that can be made to maintain the sustainability of city identity is to maintain the authenticity and specifications of various elements that make up urban areas in the midst of the pressure of urbanization, rapid urban development, heterogeneity and complexity in urban areas. Moving the nation's capital to a new location also adds to the pressure on the authenticity and sustainability of city and nation identity.

Lesson-learned from Capital Relocation in Other Countries

The relocation of national capitals has been carried out in several countries in the world. The relocation of the capital was caused by many factors and considerations that varied according to the needs of the country at that time. Before specifically discussing the relocation of the capital city of the Republic of Indonesia, it is important to pay attention to the lessons learned from the experience of relocating the capital in several countries, especially from the perspective of city identity and sense of place. As for several countries that have moved their national capitals, including India, Pakistan, Nigeria, Australia, Brazil, Myanmar, Tanzania and Malaysia.

The reasons for relocating the capital are very diverse, namely the problem of natural disasters, overpopulation and limited land, decreased productivity levels due to congestion, to maintain unity, reasons of defense and security, and so on. However, the transfer of the capital has not always been smooth and successful. Brazil, Myanmar, Tanzania and Malaysia are some examples of efforts to relocate national capitals that have been less successful due to many inhibiting factors. The 8 countries mentioned previously consist of 8 new capitals and 8 old capitals which can be analyzed based on the identity of their capital city in the table 1.

Table 1. City Identity of Old-New Capital in Some Countries

No	Country Year of Relocation	City Identity	
		Old Capital	New Capital
1	India, 1912	Kolkata: postcolonial city, acculturation of various cultural elements from India and also Chinese, the center of industry and the Indian Independence Movement, a city at the mouth of the Ganges.	New Delhi: a city designed by the British, a symbol of British power that can be seen from its architecture, a landlocked city, a place for the Hindu majority, a place for multi-ethnic and multi-cultural communities who live together.
2	Australia, 1927	Melbourne: one of the most populous cities in Australia, home to Indigenous Australians before the arrival of the British, rich historical and cultural heritage, Victorian (British) architectural style, center of industry and property market, coastal city on estuary of Yarra river.	Canberra: inland city, a planned city, was selected through an International city design contest won by American architects, a garden city that is green and have lots of natural vegetation, a capital that has no governance at the local level.
3	Brazil, 1960	Rio de Janeiro: the colonial city, a city that includes mountainous and waterfront areas, is predominantly Catholic, is the main tourist city in Brazil, its culture and architecture are influenced by Portuguese, British and French styles.	Brasilia: highlands city, has a unique-artistic urban planning and modern architectural style, located in the middle of Brazil, the original city was planned, designed as a dragonfly/airplane/bird-like shape consisting of two components, namely a monumental axis and a residential axis.
4	Pakistan, 1967	Karachi: seaside city, received a lot of influence from the British especially in its transformation as a port city, industrial and financial centers, a city that become the destination of Muslim refugees from various countries.	Islamabad: inland-hilly city, planned city, designed by Greek Architect with grid plan, Islamic city, modern architectural style combined with Islamic and traditional styles.
5	Tanzania, 1973	Dar es Salaam: a coastal city, the city with the largest population, the center of economy and business, the center of culture and arts, started as a coastal fishing village which was influenced by Islam (Sultan Majid bin Said from Zanzibar) so that it was named Dar es Salaam (house of peace), was occupied by Germans and British.	Dodoma: inland city, located in the center of the country of Tanzania, was discovered by the colonialists from Germany, its layout follows a colonial planning with a separation from the indigenous villages, following the design of a garden city due to the separation between the population and industrial sites.
6	Nigeria, 1991	Lagos: a coastal city consisting of islands, port city, financial and business center, architectural style combination of tropical-vernacular, European colonial and modern, multi-religion city.	Abuja: a planned city, inland city, which is among the most populous cities in Nigeria, has many major religious sites such as Islam and Christianity, was chosen as the new location because of its position in the center of Nigeria's territory.
7	Malaysia, 1999	Kuala Lumpur: metropolitan city, cultural and economic center, river estuary city, multi-ethnic and multi-religious city, historically has been a city dominated by Chinese people, a tourist city, with a combination architectural style (colonial, Asian, Malay Islam, modern and post-modern).	Putrajaya: a predominantly Muslim city, a riverside-inland city, a planned and designed as garden city, was chosen as the location of the capital due to overpopulation and congestion in Kuala Lumpur, the administrative center.
8	Myanmar, 2005	Yangon: Myanmar's most populous city, commercial center, center of colonial buildings and heritage, estuary city, once colonized by British, city without skyscrapers, city with grid pattern, dominated by Buddhism.	Naypyidaw: a planned city, located in the center of the country of Myanmar, a city with a large area and low population density, a city in a mountainous region.

Based on table 1, it can be seen that some changes have occurred regarding the city identity in the new capital. These changes are caused by changes in the characteristics of the location from the geographical side to the socio-cultural (human aspect). The majority of the selected capital locations are cities that are planned and designed according to needs, not cities that are formed from a long history and long process of development. In addition, the location selection for the new capital generally takes into account the position of the country's territory, to place the new capital in the center of the country's territory. The success or failure of relocating the capital city is strongly influenced by various factors that are complex and interrelated. Such as the case of Malaysia, Brazil, Myanmar and Tanzania; the new capital is unable to defeat the domination of the old capital's image which is deeply rooted in the identity of the capital and even the country or nation.

Opportunities and Challenges for Identity Sustainability in Indonesia's New Capital

The relocation of the capital city of Indonesia from Jakarta to the North Penajam Paser Regency and parts of the Kutai Kartanegara Regency in East Kalimantan Province is a big issue. Even the discourse about moving the capital city has been put forward by the presidents in previous eras. The reasons for relocating the capital of Indonesia, among others: the level of population density on Java island which is already very high due to the unequal distribution of the population to other islands in Indonesia, the unequal economic contribution of other islands to Indonesia's gross domestic income due to the dominance of economic contribution of Java, the crisis of water supply, and land conversion that dominate or the high level of land consumption for development [11]. In addition, other reasons that cause the need to move the capital are the high growth rate of urbanization in Jakarta, the increasing burden on Jakarta which is in line with the decreasing environmental capacity and impacts on the economic sector [12].

The selection of the North Penajam Paser Regency and Kutai Kertanegara Regency, East Kalimantan was based on several considerations. Bappenas (National Planning Agency) revealed the reasons for choosing the province of East Kalimantan, including: large area of delineation and potential location, quantity of surface water and groundwater capacity, delineation areas with lower risk of forest fires, located close to two big cities (Samarinda and Balikpapan) so that access is easier, the low potential for social conflict because it is dominated by immigrants ethnic, and is supported by land-sea-air access that supports defense and security [13].

The awareness of the importance of the national capital as a representation of state and nation's identity of the Republic of Indonesia has made Bappenas make plans related to the identity of the new capital. Bappenas proposes several important points related to the identity of the new capital, including: as a symbol of national identity, a capital that is green-smart-beautiful-sustainable, modern and follow International standard, and has efficient and effective governance [12]. This concept has a great possibility to be implemented because as a planned city there is an opportunity to form the desired city image even from the early stages of planning and development. In addition, another opportunity related to the identity of this new capital is the potential to maximize land use in the development of elements of city identity, such as buildings and open spaces. In addition, with the relocation of the capital to a new location, it is possible to absorb local culture and geographical conditions that can contribute to supporting the formation of the new capital identity.

The discourse of moving the capital to a new location not only has a positive side from the opportunities that arise related to identity, but also there are many challenges that can potentially hinder the formation of the identity of the nation and state of Indonesia which is represented through the new capital. Indonesia and Jakarta as the nation's capital since independence until now are two things that are very close and inseparable from each other. The city of Jakarta is the heart and witness of the long history of the Indonesian state and nation. The city of Jakarta and its surroundings have become the center of important activities in Indonesia. The relocation of the capital to a new location may provide an opportunity to form a better and more planned capital identity, but the built environment as a result of this planning cannot completely replace the values contained in the old capital. The domination and impression about the old capital will be very difficult to be replaced by the new capital, not only for the Indonesian population but for the International communities. Jakarta has its own sense of place for everyone more than as capital city of Indonesia. In addition, moving the capital to a new location allows the degradation of local identity and the areas around it due to the new capital. The fading or changing of this local identity is a challenge, especially for indigenous people. It is hoped that the domination of immigrants that coincides with the construction of the new capital is expected not to threaten and even eliminate local identities that have existed for a long time. On the other hand, new capital can still represent the heterogeneous identity of the Indonesian nation.

It is hoped that awareness of the opportunities and challenges associated with the identity of the new capital can provide considerations from different perspectives. The identity of the Indonesian nation and

state that has been represented for a long time in the City of Jakarta is a clear example of the sustainability of the capital city's identity which has been preserved from generation to generation. In addition, learning from the experiences of various countries that have previously moved their national capitals, the change in the identity of the capital and the nation is greatly influenced by whether or not the planning and design of the new capital is suitable. The formation of this identity also has a contribution to the success or failure of efforts to move the capital city.

Conclusions

Efforts to maintain the sustainability of the capital's identity are very urgent in the midst of discourse on moving the capital to the new location. The identity of the nation's capital is something that must be passed on to future generations. In several countries in the world that have moved their national capitals to new locations, it can be seen that there have been some changes in city identities as the influence of location characteristics, human aspects, and planning and design of new capitals. For Indonesia, moving the new capital city has 2 sides, namely opportunities and challenges. The opportunities obtained from the discourse on moving the capital include: flexibility in implementing the design concept and planning the image of the capital because it is included in the planned city category, the opportunity to maximize land for the construction of elements of city identity, as well as the potential for cultural absorption and location characteristics to contribute in shaping the identity of the new capital. In addition, the challenges faced by the sustainability of the identity of the new capital, namely: the domination of the old capital's identity for the Indonesian population and the international community, inherent historical and cultural values, and the possibility of disappearance of local culture and identity. Therefore, the results of this study are expected to be able to provide perspectives and considerations in terms of city identity on the discourse of relocating Indonesia's capital city to East Kalimantan. In addition, a recommendation for further studies related to this topic is a study that specifically discusses about the elements that form the identity of the new capital, in order to obtain a more detailed and in-depth study result.

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Analysis of Total *Eschericia Coli* at Karang Mumus River, Samarinda City

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Abstract

The aim of this research is to know the amount of Eschericia coli bacteria at Karang Mumus River in Samarinda City. This research was conducted in September-October 2019. The sampling was done at 8 stations along Karang Mumus River and laboratory tested by MPN (Most Probable Number) method while data analyzed by t-test. The result showed the total amount of E. coli bacterial was around 11-1100 MPN/ml and inclusive in Station 8 with 1100MPN/ml was in polluted status. T–test result showed the amount of the bacterial in high tides and low tides at Karang Mumus River were not significantly different. The pH result was around 5.27-6.53, the DO was around 2.21-8.26, CO_2 was around 1.40-7.39 and the H_2S was around 4.8-7.2.

***Keywords**: Water Quality, Bacteria, Eschericia Coli, Karang Mumus*

Introduction

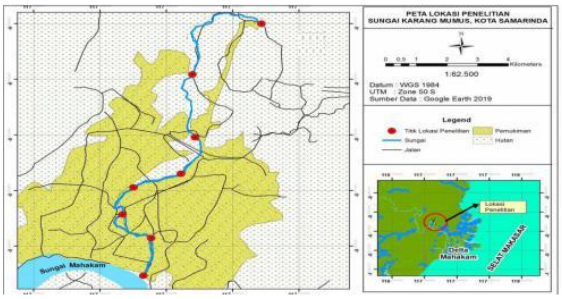

Figure 1. Research Location

The Karang Mumus watershed is geographically located at 0°19'118.93" - 0°116'54.72" South Latitude and 117°12'06.24" - 117°I5'41.27" East Longitude. Administratively, Karang Mumus watershed is located in Samarinda City and Kabupaten Kutai Kartanegara. The Karang Mumus watershed includes upstream area belongs to Kabupaten Kutai Kartanegara (Kecamatan Muara Badak), while the central part of Karang Mumus watershed covers Samarinda City (Kecamatan North Samarinda), and the downstream part of Karang Mumus watershed belongs to Samarinda (a small part of Kecamatan Samarinda Ulu and a small part of Kecamatan Samarinda Ilir).

The Karang Mumus River flows through the city centre with a dense population, in addition to various types of population activities such as agriculture, hospitality, markets and the economy that can be caused the amount of water waste increasement. Water sampling of Sungai Karang Mumus was conducted at 8 research stations which were then divided into 3 parts namely the upstream, central, and downstream sections.

Station I to Station II is an upstream section that starts from Bendungan Benanga to Jembatan Tepian Lempake, which is also a local agricultural and plantation area. Station III to station VI is the central part.Station III is Jembatan Gelatik as educational area. Station IV passes the Jembatan S. Parman which is a residential area. Station V and station VI pass Jembatan Nibung and Jembatan Perniagaan which enters Pasar Segiri. Station VII to station VIII is a downstream section that has the potential to source polluters from malls and densely populated settlements to the body of the Sungai Karang Mumus. *E.coli* was first isolated by Theodor Escherich from the stool of a small child in 1885. The name Escherichia was given in 1920 as a tribute to Theodor Escherich (Berg in Adriana, 2017). Bacteriological water inspection in the water aims to know the qualitative and quantitative content of bacteria. Azwar (1981) reported that Escherichia coli bacteria can be used as pollution indicator bacteria, as they are found in all waters and generally come from human or warm-blooded animals as well as from water that has been contaminated by organic waste because these coliform bacteria are "oppurtunis pathogens" that are bacteria that can sometimes cause disease.. Therefore, often *Escherichia Col*i bacteria are called fecal coli bacteria or fecal coli or fecal colic. In research conducted by Meliala et al (2014), mentioned from one source that rising temperature, humidity, salinity and pH in an environment led to the easy proliferation of coli bacteria including *Eschericia coli*. According to Tristyanto (2015), Eschericia coli bacteria can cause several diseases, including Urinary Tract Infections, Diarrhea/ Gastroenteritis, Sepsis, Meningitis. Based on the research problem above, the purpose is to know the amount of *Eschericia Coli* Bacteria as the microbiology indicator of water quality in Sungai Karang Mumus Kota Samarinda.

Materials and Methods

The research method of this study was (MPN) Most Probable Number which was used to know the existence of coliform bacteria including *Eschericia Coli* bacteria. Water to be tested is diluted serially and inoculated in lactose broth, coliforms if present in water utilizes the lactose present in the medium to produce acid and gas. The presence of acid is indicated by the color change of the medium and the presence of gas is detected as gas bubbles collected in the inverted Durham tube present in the medium. The number of total coliforms is determined by counting the number of tubes giving positive reaction (i.e both color change and gas production) and comparing the pattern of positive results (the number of tubes showing growth at each dilution) with standard statistical tables. The steps in the MPN method are as follows:

Preparation of The Medium

The Growth media for *Eschericia Coli* analysis used three mediums namely Lactose Broth for presumptive test, (BGLB) Briliant Green Lactose Broth for confirmation test, and (EMBA) Eosin Methylene Blue Agar (completed test). Media making for the presumptive test was carried out by dissolving Lactose broth 1.3 grams into 1 liter of aquades. For the preapration of confirmation test was done by dissolving 6 grams of Briliant Green Lactose Broth with 1 liter of aquades. The preparation of the completed test media was carried out by dissolving Eosin Methylene Blue Agar (3.6 grams and 1 liter of aquades).

Presumptive test

The presumptive test is carried out using 3 series of tubes. Take 1 mL of sample solution each dilution and put in a tube containing medium Lactose broth as much as 9 mL and Durham tube. Further incubation for 24 hours with a temperature of 37 °C ± 0.5. If for 24 hours there is no change to the medium and no gas is arising then the incubation continues 48 hours. If within 48 hours no gas is formed in the Durham tube then it is counted as a negative result.

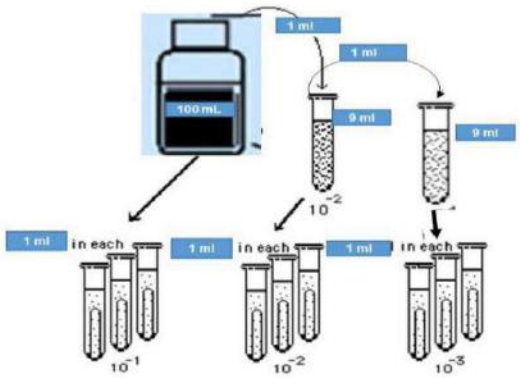

Figure 2. Dillution

Confirmation test

Confirmation tests are carried out by taking 1 ml of each culture that shows positive results then inoculated into a new medium, namely (BGLB) Briliant Green Lactose Broth. Prior to the inoculation, all the tubes containing Briliant Green Lactose Broth were then given durham tubes to determine the amount of gas produced by the bacteria in the water samples. Next incubation temperature -+36-37 °C for 48 hours.

Completed test

Completed test were conducted by taking a tube that showed a positive reaction (gas arising on the durham tube) then inoculating the media breed (EMBA) of eosine methylene blue agar, by taking 1 ml of each positive culture. After that incubation for 24 hours at a temperature of 35°C. If the durham tube contains >10% gas then the test positive sample contains *E.coli.*

Calculation of MPN

Calculation of MPN according to (Waluyo, 2008) is done by taking 3 series of tubes on each dilution which is calculated positive tubes, for example on the first dilution of 3 tubes that intersect positive growth, the second dilution of 2 positive tubes and the third dilution of 1 positive tube. After that it is combined into 3,2,1. The combination number is then matched to the MPN table.

Results and Discussion

The results of the study were conducted at three stages using each of the different media, showing the number of positive tubes containing different coliform bacteria. Here are the results of each stage.

Presumptive Test

Positive results containing coliform bacteria will show a murky color and there are gas bubbles formed by

bacterial activity, while for negative tubes do not show clouding and the absence of bubbles or gases formed by the activity of coliform bacteria.
In all water samples conducted dilution of 10^{-1}, 10^{-2}, and 10^{-3} showed positive results from Station I to Station VIII. The results of this stage test are shown in Table 1.

Table 1. Result of presumptive test

Sampel Code	High Tides			Low Tides		
	10^{-1}	10^{-2}	10^{-3}	10^{-1}	10^{-2}	10^{-3}
I A	+	+	+	+	+	+
I B	+	+	+	+	+	+
I C	+	+	+	+	+	+
II A	+	+	+	+	+	+
II B	+	+	+	+	+	+
II C	+	+	+	+	+	+
III A	+	+	+	+	+	+
III B	+	+	+	+	+	+
III C	+	+	+	+	+	+
IV A	+	+	+	+	+	+
IV B	+	+	+	+	+	+
IV C	+	+	+	+	+	+
V A	+	+	+	+	+	+
V B	+	+	+	+	+	+
V C	+	+	+	+	+	+
VI A	+	+	+	+	+	+
VI B	+	+	+	+	+	+
VI C	+	+	+	+	+	+
VII A	+	+	+	+	+	+
VII B	+	+	+	+	+	+
VII C	+	+	+	+	+	+
VIII A	+	+	+	+	+	+
VIII B	+	+	+	+	+	+
VIII C	+	+	+	+	+	+

Source: Personal Data (2018)

Keterangan:
(+) : Positive tube
(-) : Negative tube

Based on Table 1. it is known that all samples in each dilution showed positive results of coliform bacteria. This can be caused by the dilution of these water samples that are inserted in the tube having a high level of pollution so that there is a growth of coliform bacteria derived from the water sample. On a positively calculated tube, the liquid media will turn into a murky color as well as a gas bubble appears on the durham tube that is placed upside down in the media. The emerging gas bubbles indicate the activity of coliform bacteria capable of fermenting lactose by producing acids and gases within an incubation time of ±48 hours at a temperature of 36°C. This is the same as that presented by Fardiaz (1993) in Widiyanti et.al (2004) regarding the determination of positive tubes of test results. Negative inoculation results are characterized by a fixed media color and there are no bubbles in durham tubes in the media. In stage 1 media the declared positive tube indicates that it contains colic in general.

Confirmation Test

Table 2. Result of confirmed test

Sample Code	High Tides			Low Tides		
	10^{-1}	10^{-2}	10^{-3}	10^{-1}	10^{-2}	10^{-3}
I A	+	+	+	+	+	+
I B	+	+	+	+	+	+
I C	+	+	+	+	+	+
II A	+	+	+	+	+	+
II B	+	+	+	+	+	+
II C	+	+	+	+	+	+
III A	+	+	+	+	+	+
III B	+	+	+	+	+	+
III C	+	+	+	+	+	+
IV A	+	+	+	+	+	+
IV B	+	+	+	+	+	+
IV C	+	+	+	+	+	+
V A	+	+	+	+	+	+
V B	+	+	+	+	+	+
V C	+	+	+	+	+	+
VI A	+	+	+	+	+	+
VI B	+	+	+	+	+	+
VI C	+	+	+	+	+	+
VII A	+	+	+	+	+	+
VII B	+	+	+	+	+	+
VII C	+	+	+	+	+	+
VIII A	+	+	+	+	+	+
VIII B	+	+	+	+	+	+
VIIIC	+	+	+	+	+	+

Source: Personal Data (2018)

Keterangan:
(+) : Positive tube
(-) : Negative tube

Results showing positive tubes in the next stage 1 test were transferred on the Briliant Green Lactose Broth (BGLB) media which is a second stage test or confirmation test. BGLB media is a selective medium containing bile salts that is able to inhibit the growth

of bacteria that do not live in the human digestive tract and contain brilliant green that can inhibit the growth of certain gram-positive and gram-negative bacteria in addition to fecal koliform. The results of the second phase test are presented in Table 2.

Table 3. Result of completed test

Sample Code	High Tides			Low Tides		
	10^{-1}	10^{-2}	10^{-3}	10^{-1}	10^{-2}	10^{-3}
I A	+	-	+	+	+	-
I B	-	-	+	-	+	-
I C	-	-	-	-	+	-
II A	+	+	+	-	+	-
II B	+	-	-	+	+	-
II C	-	-	-	+	+	-
III A	+	+	-	+	+	-
III B	+	+	-	+	+	+
III C	-	-	-	-	-	-
IV A	+	+	+	+	+	+
IV B	-	+	+	+	+	+
IV C	-	+	+	-	-	-
V A	+	+	+	+	+	+
V B	-	+	-	+	+	+
V C	+	+	+	-	+	-
VI A	+	+	+	+	+	+
VI B	+	+	-	+	-	+
VI C	+	+	-	+	+	+
VII A	+	+	+	+	+	+
VII B	+	+	+	+	+	-
VII C	+	+	+	+	+	+
VIII A	+	+	+	+	+	+
VIII B	+	+	+	+	+	+
VIIIC	+	+	-	+	+	+

Sumber: Personal Data (2018)

Keterangan:
(+): Positive tube
(-): Negative tube

Table 2. showing positive results containing coliform at I-VIII stations dilution 10-1 to 10-3 in repetitions A, B, and C. According to Nugroho (2015), coliform bacteria including Eschericia coli have properties capable of producing acids and gases. The gas derived from the activity of these bacteria can be seen in durham tubes placed in the test tube, while the acid formed causes the discoloration to become murky in the media Briliant Green Blue Agar (BGLB).

Completed Test

Since some of the positive results from the confirmatory test may be false, it is desirable to do completed tests. In the third stage test or booster test using Eosin Metylen Blue Agar (EMBA) media which is a selective medium to know the growth of Eschericia coli bacteria shown with special features and easy to observe. Tubes that showed positive contained Eschericia coli bacteria in previous tests then inoculated in EMBA media. Here's Table 3 which presents the results of the inoculation at the completed test stage.

So from the three stages of testing on each media shows different positive tube results. This is because testing using mpn methods has different objectives using media with specifications at each stage. Results from testing E. coli bacteria with MPN tables are presented in Figure 8.

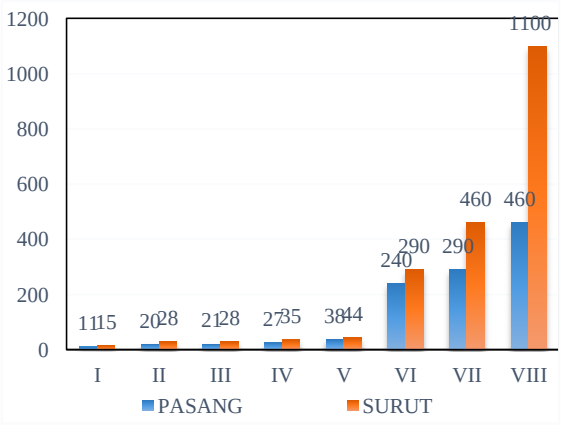

Figure 3. Result of bacteri E.coli

Based on picture above, can be concluded that the amount of *E. coli* bacteria at high tide with the amount of 1.107 MPN/100ml and 138.8 MPN/100ml as an average. The highest E. coli bacteria are at Station VIII with 460 MPN/100ml and the lowest at Station I with 11 MPN/100ml. Meanwhile, the amount of E. coli bacteria at low tide with the amount of MPN/100ml and 250 MPN/100ml as an average. The highest E. coli bacteria are at Station VIII with 1.100 MPN/I00ml and the lowest at Station I at 15 MPN/100ml.

The increasing number of E. coli bacteria is due to the higher environmental factors such as temperature, pH, dissolved oxygen (DO), carbon dioxide (CO2), and hydrogen sulfide (H2S). Adjusting Baku Mutu Perda Kaltim No 2 Year 2011 About The Quality Standard of Water Quality Management and Pollution Control, then Karang Mumus river is included in class II with a value of 194.1875/100ml. Class II is water that can be used for water infrastructure/recreational facilities, freshwater fish

cultivation, livestock, water to irrigate plants, and/or other provisions that require the same water quality as such uses.

Conclusions

Based on the results of the research can be concluded that there are bacteria *Escherichia coli* at 8 research sites throughout the flow of The Karang Mumus River of Samarinda City. At high tide the amount of E.coli bacteria reaches 2214 MPN/ml with an average of 138.375 MPN/100ml. Meanwhile, at low tide the amount of E.coli bacteria reaches 4000 MPN/ml with an average of 250 MPN/100ml. From the results of the T Test shows that the amount of E. coli bacteria at high tide and low tide does not different significantly.

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Characteristics of Qualitative Composition Of Active Compounds Tiwai Tea Results from Drying Sunlight and Power Dryers in TLC and FTIR

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Abstract

Teh tiwai is one of the herbal beverage products produced by SMEs in Kutai Kartanegara Regency of East Kalimantan Province in the form of brewed tea that is dried using sunlight but it is not yet known the qualitative composition of active compounds tiwai tea in Thin Layer Chromatography (TLC) and FTIR so that research is carried out with the aim to know the intensity of fluororence of TLC results and the results of FTIR transmitting from solar and electrical drying. against the qualitative composition characteristics of the active compound tiwai tea by drying the onion bulbs using sunlight and electric dryer automatically until dry, then packaged. Tiwai tea products further analyzed the qualitative composition of the active compounds tiwai tea in thin layer chromatography (TLC) and FTIR systems. From the KLT system, and FTIR shows the intensity of fluororesensi teh tiwai drying with sunlight performed by SMEs has a higher sensitivity compared to tea tiwai the result of electrical drying, as well as in ftir spectrum readings, it is obtained that the tea tiwai the result of electrical drying has a higher transmitter compared to the result of drying sunlight. This means that the %absorbance of tea is lower in the drying result of the electric dryer. This result is in accordance with the readings in the KLT system, namely the higher fluororesence intensity of the sun drying results. Sunlight of various spectrums gives effect to the qualitative composition of the active compound Tiwai Tea.

Keywords: *Tiwai tea, TLC fluororesence intensity, FTIR transmitting*

Introduction

Tiwai onions are perturable horticultural plants, a red color that is thought to have chemical compound components so efforts are made to avoid such damage in the form of tea. Tiwai tea is one of the brewed drinks made from onions that has undergone the process of shrinking because it is dried with sunlight and dried with an electric dryer.

Sun-dried teas and electric dryers have not been known about the fluorescence intensity of TLC results and FTIR transmissions from solar and electrical drying results against the qualitative composition characteristics of the active compounds of tiwai tea. It is also conveyed by SME teh tiwai that the resulting tiwai tea products are not yet known the composition of chemical compounds and their benefits so that the products can increase the added value.

Some studies on onion bulbs have been conducted, from these studies that have done onion tubers both fresh and dried processed by extraction both maserization, sokletasi using polar solvents such as water and ethanol, while non-polar solvents such as methanol, n-Hexan, chloroform, and others both subsequently analyzed chemical compound components both phytochemically with suspected positive or negative, tested by TLC, FTIR, UV-Vis spectrophotometer and GCMS.

Simplisia extract of onion tubers with hot water solvents and ethanol contains tannin compounds, phenol, flavonoid glycosides, aldehydes, ketones, carboxylates terpenoid, naphone, plobatanin, anthocyanins and steroids monoterpenoids, seskuiterpenoids (Sukrasno et al, 2006 ; Suroto and Sampepana, 2007 ; Puspadewi et.al, 2013 ; Sa'adah et al., 2015).

Tea is commonly used for pharmaceuticals and cosmetics (Atmaja et al, 2018). Tiwai tea is very useful in the field of health (Kuntorini and Nugroho, 2010; Rachel, 2017 ; Rahmandika, 2018); anticancer (Minggarwati, 2017) ; antimicrobial (Chansukh et al. 2014) ; antifungal Trichophyton mentagrophytes (Christoper et al., 2017) ; coloring of rocking nut products (fauziati et al., 2014) ; syrup dye (Suroto et al., 2018) ; miroemulsion (Suroto et al., 2020), antibacterial (Donatus, 2016 ; Limsuwan et al, 2008; antibacterial causes of diarrhea (Nunung, 2012) ; antibacterial to Methicillin-Resistant Staphylococcus Aureus (MRSA) (Paramita et.al., 2017) ; antioxidants (Sajidah et a l., 2019) ; herbal remedies (Sukasno et al., 2006) ;prevent the decline of ifn-expressionized cells and increased the number of cells expressed cd 14 (Toeman, 2015), cosmetics in the form of

antioxidant creams (Warnida and Nurhasnawati, 2016) and collagen (Yani et al., 2020).

Based on the above description, this study was conducted with the aim of knowing the intensity of fluororence of TLC results and the results of FTIR transmitting from sunlight dryers and electric dryers against the qualitative composition characteristics of the active compounds of tiwai tea.

Materials and Methods

The materials used are onions, water, filter paper, aluminum foil, tissu, ethanol, methanol, petroleum ether, dietyl ether, reagent folin-ciocalteu, Na_2CO_3, ethyl acetate, tannic acid, TLC Silica gel 60 RP-18 F254S, Aluminum sheet 20 cm x 20 cm, capillary pipe. While the tools used are tampah, knife, telenan, basin, jar, blender, crusser, automatic power dryer, thermometer, hydrometer, analytical balance sheet, Thin layer chromatography, Fourier transformed Infra-red (FTIR), erlenmayer, funnel, glassware, chamber, hot plate, test tube, measuring glass, beaker glass, volumemetric pipette, micro pipette, test tube rack.

Tiwai Tea Making Procedure

Tiwai tea is done by means of Tiwai Onion plant that are made from leaves, tubers, roots and feces. onion bulbs that have been cleaned and sliced thinly then dried using sunlight and automatic power drying tools with a temperature of 50^{O}C. The raw materials of dried tiwai tea are packaged and analyzed with qualitative composition test parameters of the active compound of the tea tiwai resulting from drying sunlight and electric dryer in TLC and FTIR. A flow chart of the process of making tiwai tea can be seen in Figure 1.

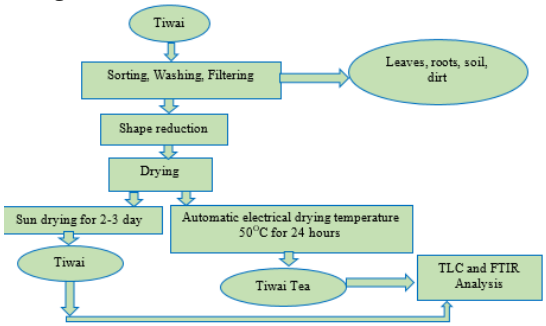

Figure 1. Flow Chart of Tiwai Tea Making Process (Sulharman et al., 2019)

Parameter Testing

Parameter Testing parameters to identify the initial presence of metabolic compounds in tiwai tea that cause langu/sepat taste using thin layer chromatography (KLC) and Fourier transformed Infra-red (FTIR) methods.

Thin Layer Chromatography (TLC)

Samples that had been extracted with methanol solvents were toholed on plates with a distance between 0.5cm and a distance of 1 cm from the bottom edge of the plate. The diameter of the totolan is attempted as small as possible and left to dry. At the desired rambat distance is marks with a pencil. Next the plate is inserted into the saturated vessel with the motion phase of thequadest:methanol (2:8) on the silica plate RP18 and the phase of motion teluan:asetonetril:chloroform (4:3:3) on the f60 gel plate. The position of the plate is upright and the bottom edge is dipped in a motion phase, but the toll is not submerged, the vessel is tightly closed, and the motion phase is allowed to creep up to the limit of the rambat distance. Plates are removed and dried in the air. Notice the patches that arise with visible light, ultraviolet at wavelengths of 254 nm and 366 nm (Hanani, 2014).

FTIR

Make a sample pellet - KBr with a comparison of the composition of KBr and the sample which is 90:10. The mixture is snared in a pestle lumpang until smooth then inserted and pressed into a 3 mm disc with hydraulic jack. Spectrum testing is conducted in accordance with the SOP of the FT-IR spectrophotometer shimadzu prestige 21

Results and Discussions

Secondary Metabolic Onion Tea Tiwai IKM Production (Sunlight) and Electric Dryer in Thin Layer Chromatography (TLC)

Secondary Metabolic Onion Tea Tiwai IKM Production (Sunlight) and Electric Dryer in Thin Layer Chromatography (TLC) on Figure 2.

Wavelength 254nm Wavelength 366 nm

Figure 2. TLC Tiwai Tea Using Sun Dryer

Based on Figure 2. Explaining that the TLC Test was carried out with four scenarios, namely tiwai tea, the tiwai which was given additional catechin compounds (polyphenol group), quinhin (polyphenol group, flavonoids), and quinine (alkaloid group). From the TLC results obtained that the standard catechins, kuersetin, and kuinin each have a value of Rf 1; 0.83; 0.18. Each tea that is given additional standards indicates a separation to the standard. This proves that the TLC system used is capable of detecting catechins, kuersetin, and kuinin mixed in the tiwai matrix. However, in tech products without the addition of standards, there are no catechin compounds, kuersetin, and kuinin. Thus, it can be concluded that the content of catechins, kuersetin, and kuinin in the tiwai is below the detection limit of the TLC system used. In the KLT system used there are two tape compounds that cannot be identified as catechins, kuersetin, or kuinin, namely at Rf 0.37 and Rf. 0.81 Both compounds are fluorescent or fluorescent at readings with UV light both at wavelengths of 254 nm and 366 nm. Both compounds need to be further characterised, for example with LC MS/MS. Based on the literature, onion extract with water solvent contains the compound Total Polyphenols (µg/mL) Total Flavonoids (µg/mL) Onion extract 455.27 Onion starch 194.06 Onion oil and onion ampas 159.52. According to Suroto et al. 2019, the total decrease in phenolic compounds, total flavonoids and antioxidant capacity is caused by storage time, packaging and temperature. suroto et al. research (2020) that extracts, starches and tubers of onions tiwai with water solvents

TLC Tea Tiwai Analysis Results of Electrical Drying

TLC Tea Tiwai Analysis Results of Electrical Drying can be seen on figure 3.

Wavelength 254nm Wavelength 366 nm

Figure 3. TLC Tiwai Tea Using Electric Dryer

Figure 3. Explaining that there are similar profiles of KLT the tiwai results of solar drying with samples obtained from the industry with the result of electrical drying. However, for the KLT results from the tiwai dried with an electric dryer has a dimmer ioning intensity when compared to KLT tea tiwai dried with sun. In Figure 2 and 3 occurs this is due to continuous heat continuously for 24 hours with a temperature of 50^{O}C during electrical drying resulting in volatile compounds evaporating, while in the drying of sunlight the time used to dry with the sun about 6 hours with the hotst temperature (30-40^{O}C), in addition to the absence of ultra violet rays from sunlight can react to compounds in dried onion bulbs turned into other compounds.

Fauziati et al. (2017) revealed the arrival of several chemical compounds contained dried onions extracted with ethanol, namely phenol compounds, octadecanoic acid, linoleate achid ethyl ester, eicosane, hexadecanoid acid, androstand-6-one(5alpha)/dihydrofurobenzopyren, while in fresh onion tubers contain compounds compesterol, stigmasterol, gamma-sitosterol, linoleic acid, tetradecanoid acid, coumarine. This compound serves as an anticholesterol, anti-cancer, cosmetic ingredient. Fauziati et al. (2014) also revealed that there are compounds in onion bulbs used as dyes of rocking nut products containing octadec-9-enoic acid compounds, 9-octadecanoid acid, red oil, phenol, vinylphenol, squalene, and some anticholesterol compounds and vitamins such as gamma-tecoferol, delta-tecoferol, o-methyl-, vitamin E, in-alpha-tecopherol.

In addition, the storage time of tiwai tea is strongly influenced by the chemical compounds that exist in tiwai tea. In research into the manufacture of onion syrup by Suroto et al. (2018) revealed that too long storage time can lower levels of phenoloi, flavonoids, antioxidant activity.

Tiwai Tea Analysis using sun dryer and power dryer in FTIR.

Tiwai Tea Analysis using sun dryer and power dryer in FTIR on figure 3.

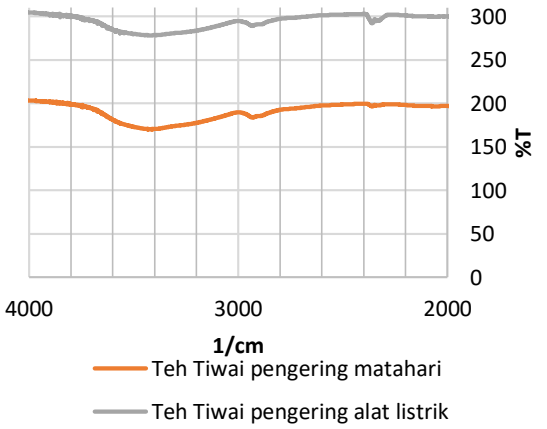

Figure 4. Tiwai Tea Analysis using Sun Dryer and Power Dryer FTIR

Figure 4 shows the full spectrum of FTIR from the tiwai products dried with the help of sunlight and electric dryers. In general, the FTIR spectrum profile is almost the same, in a single bond zone thought to be affected by clusters –OH and methyl (-CH3), then there are several peaks in the double bond zone, and there are several peaks in the identification zone that are specific to the tiwai. The FTIR identification zone of a product is generally at wave numbers 1500 to 400 cm-1.

Tabel 1. Identification based on Tiwai peak wavelengths

Identification based on Tiwai peak wavelengths			
Wave Length (1/cm)	Possible bond	%T	
		Umbi Tiwai	Teh Tiwai Industri
		A	B
3419	O-H	93.10	70.24
2917	CH3	103.14	84.77
1151	RCOOCRO	94.47	69.16
988	C=C	93.27	61.85
921	C=C	98.59	77.73
844	aromatic ring	99.55	82.24
719	C=C, C-Cl	94.60	76.34
668	C-Cl	81.80	73.31
575	C-Cl	91.53	69.72
510	n/d	92.16	71.38

Table 1 describes in more detail the peaks of FTIR spectrum identification of tiwai tea with Electric Drying and Sun Drying. At 3419 cm-1 waves, %T tubers dried with an electric dryer are higher than industrial tiwai tea (sun drying). A peak of 3419 cm-1 is identified as a cluster –OH. At 2917 cm-1 waves, %T bulbs dried with an electric dryer are higher than the tiwai industry (drying sunlight). A peak of 2917 cm-1 is identified as a cluster $–CH_3$. At 1151cm-1 waves, %T bulbs dried with an electric dryer are higher than the tiwai industry (drying sunlight). A peak of 1151 cm-1 is identified as a cluster – RCOOCRO. At wave number 998-1, %T and wave number 921-1, %T bulbs dried with an electric dryer are higher than the tiwai industry (sunlight drying). Peak 998 cm-1 and peak 921-1, %T identified as cluster –C=C. At wave number 844-1, %T bulbs dried with an electric dryer are higher than the tiwai industry (drying sunlight). The peak of 844 cm-1 is identified as an aromatic ring cluster. At 719 cm-1 waves, %T bulbs dried with an electric dryer are higher than the tiwai industry (drying sunlight). A peak of 719 cm-1 is identified as a cluster –C=C, -C-Cl. At wave number 668-1, %T and wave number 575-1, %T bulbs dried with an electric dryer are higher than the tiwai industry (drying sunlight). Peak 668 cm-1 and peak 575-1, %T identified as cluster –C-Cl. And Peak 510 cm-1 %T unidentified.

Conclusions

From the KLT system, tea tiwai drying with sunlight carried out by the industry has a higher sensitivity compared to the tiwai results; electrical drying as evidenced by its higher fluororesence intensity. Ftir spectrum readings, obtained by the tiwai of electrical drying results have a higher transmit than the result of drying sunlight. This means that the %absorbance of the tiwai result of drying the electric dryer is lower. This result is in accordance with the readings in the TLC system, namely the higher fluororesence intensity of the sun drying results. Sunlight of various spectrums gives effect to the qualitative composition of active compounds of the tiwai.

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Kinetic Study of Activated Solid Waste Adsorbents for Removal Methyl Orange in Batch Reactor

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Abstract

The Solid waste (i.e.tea leaves, coffee ground and coconut shell) was used in this research as adsorbents. Solid waste was activated using physical and chemical activation in lab-scale experiments. The calcination temperature of 200, 400 and 600 ºC were used to improve adsorption capacity to remove methyl orange in 500 mL batch reactor. Temperature of 600 ºC was found as the optimum result of adsorption capacity. Adsorption isotherm model was fitted with Freundlich equation. Variation of adsorbent concentrations were 0.1, 0.25, and 0.5 gram.

Keywords: *Solid waste, Adsorption, Batch Reactor*

Introduction

Methyl orange (MO) is a typical organic azo dye functional group (R1–N=N–R2) that consists of two aromatic compounds which widely used in the textiles industry (Kariyajjanavar, Jogttappa, & Nayaka, 2011; de Oliveira et al., 2011. Previous results showed its resistance to biodegradation (O'Neill et al., 2000; Rajaguru, Kalaiselvi, Palanivel, & Subburam, 2000). In other hand, many previous studies found that living organisms and ecological systems were disturbed due to intense of MO color and its hazardous effect. (Brown & Dietrich, 1983; Chung, Fulk, & Andrews, 1981). Then, the need for the dye wastewater removal has increasing consideration to recover environmental quality.

Various treatment processes for removal dyes from wastewaters, such as ozonation, coagulation, photocatalytic degradation and adsorption have been widely investigated, which adsorption is one of the most effective methods that have been successfully employed for dye removal. Adsorption is a low-cost techniques for the treatment of organic pollutants present in water. Activated carbon (AC) is the most common adsorbent for adsorption process due to its effectiveness and versatility. AC is usually obtained from materials with high carbon content and possesses a great adsorption capacity, which is mainly determined by their porous structure. Adsorbent is an amorphous carbon material that needs to be activated at high temperature in furnace. Activated adsorbent can be used as a bleaching agent (dye remover) (Rahayu in Asbahani, 2013). Adsorption capacity was generally described by a graphic representation of the distribution ratios of adsorbate adsorbed per unit mass of the adsorbent and the concentration of the unabsorbed adsorbate at constant temperature. This graphic representation is known as the adsorption isotherm. Several types of adsorption isotherms have been reported in the literature, but the most widely used are the Freundlich and the Langmuir isotherms.

The organic solid waste is often considered as pollutant and mostly ended at sanitary land fill (Abu-Daabes et al. 2013). Meanwhile it has potentional benefit in adsorption treatment process. The solid organic waste such as tea leves, coffee ground and coconut shell can be used as alternative materials for adsorbent or activated carbon. This is because those materials have high amount of organic content, locally available and there is a high amount of waste material that can be transformed to be a value-added product. Raw materials derived from organic materials can be made into activated charcoal because they contain carbon (Yusufu et al, 2012). Tea leves, coffee ground and coconut shell are inexpensive and easy to obtain and are included in organic materials that can be turned into activated charcoal. The content of Tea leves, coffee ground and coconut shell include a total carbon of 47.8-58.9%, a total nitrogen of 1.9-2.3%, ash of 0.43-1.6%, and cellulose of 8.6% (Caetano, 2012)

For this purpose, activated carbon was prepared from various wastes. It was revealed that the adsorption capacity of AC depends on many factors. Types of precursors used for AC preparation and variation of activation temperatures are also main factors. In this research, tea leves, coffee ground and coconut shell were used and be made into activated charcoal for use as an adsorbent or absorbent material.

Materials and Methods

Experimental

Adsorbate MO, an anionic pollutant in which the chemical formula of $C_{14}H_{14}N_3NaO_3S$, MW of 327.33 g/mol, was selected as the adsorbate in this research work. The initial and final concentrations of MO were analyzed using y spectrophotometer UV-Vis with λmax of 464 nm

Adsorption experiments

The adsorption capacity of AC was tested for the removal of MO from the aqueous solution. The effects of absorbent precursors, adsorbent dosage, adsorbent activation temperatures, and contact time were studied. The AC 0.1; 0.35; and 0.5 g in 500 mL of 10 mg/L of MO solution at 30 °C in a shaker bath at 240 rpm/min for 0-25 min were carried out. Experiments were performed in triplicate and the results were averaged.

Preparation of AC

An amount of Tea leves (TE), coffee ground (CG) and coconut shell (CS) was taken from Smarinda Area. Those materials was put in an oven at 105 °C for 24 hours. Afterward, it was put into a furnace at 200, 400, and 600 °C for 120 min to become activated carbon. The AC was repeatedly washed with distilled water until its filtrate was neutral.

Table 1. Preliminary Adsorption

Adsorbent	C(mg/L)
CS 0.1 gr	9.711
CS 0.25 gr	9.781
CS 0.5 gr	9.562
TE 0.1 gr	9.497
TE 0.25 gr	9.505
TE 0.5 gr	9.545
CG 0.1 gr	9.335
CG 0.25 gr	9.348
CG 0.5 gr	9.308

Results and Discussion

Preliminary Adsorption Investigation

The preliminary was to investigate each suitably prepared carbon and select which one should be used for the removal of MO from aqueous solution. According to the results in Table 1, there was a noticeable variance in the adsorption capacity of the three adsorbents used to remove MO from aqueous solution. This indicated that different adsorption mechanisms controlled the interactions between these carbon surfaces and MO in the aqueous solution. The optimum result was found at ground coffee activated carbon.

Influence of Agitation Time and Activation Temperature

The effect of agitation time and activation temperature on the adsorption of MO using CG is given in Table 2. As agitation time increased, the MO removal rapidly increased and then slowed down until reaching steady constant adsorption, which indicated the achievement of equilibrium and after which there was no further increment in the adsorption. It showed the initial fast removal of MO followed by a noticeable decrease in the rate as the rate of change approached zero, *i.e.*, equilibrium was attained. When CG became saturated due to the MO molecules gradually occupied the lower energy sites, which resulted in the decrease of the average binding energy on the surface. The optimum result was found at 600 °C.

Table 2. Influence of agitation time and activation temperature

Activation Temperature	t (min)	Ct (mg/L)	Ct/C_0
200	0	10.0618	1.0062
	5	9.3084	0.9952
	10	9.9523	0.9952
	15	9.9610	0.9961
	20	9.9654	0.9965
	25	9.9304	0.9930
400	0	10.0618	1.0062
	5	10.5567	1.0557
	10	10.6224	1.0622
	15	11.6956	1.1696
	20	11.6167	1.1617
	25	11.4415	1.1442
600	0	10.0618	1.0062
	5	9.3390	0.9339
	10	8.6207	0.8621
	15	7.8454	0.7845
	20	8.4104	0.8410
	25	8.3316	0.8332

Adsorption Isoterm

The adsorption characteristics for wide range of adsorbate concentration are mostly described by adsorption isotherm (Freundlich and Langmuir),

which relates the equilibrium adsorbate concentration in the bulk and the uptake of adsorbate on the adsorbent surface. Percentage removal of MO at a fixed adsorbent dose was monitored with time. The kinetics of MO removal by adsorbents indicated rapid binding of MO to the sorbent during first few minutes, followed by a slow increase until a state of equilibrium in 25 min was reached. The initial rapid phase may be due to increased number of vacant sites available at the initial stage, as a result there was an increased concentration gradient between adsorbate in solution and adsorbate on the adsorbent. Generally, when adsorption involves a surface reaction process, the initial adsorption is rapid. The results was followed by Freudlick with R^2= 0.9652.

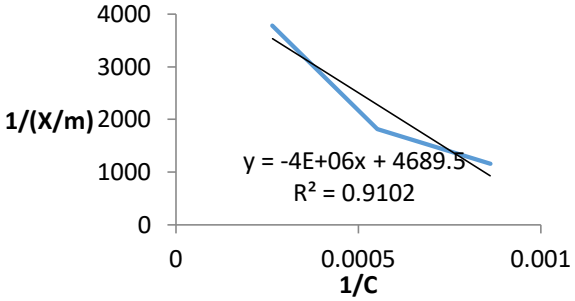

Figure 1. Langmuir Plot

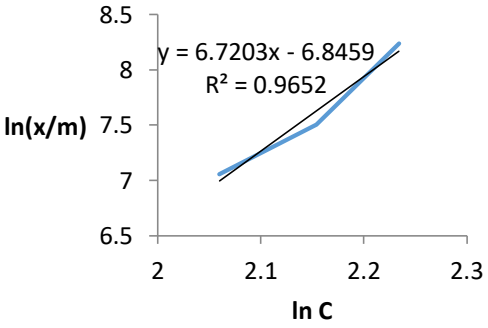

Figure 2. Freudlich Plot

Conclusion

The optimum adsorption capacity at equilibrium (q) of MO was ground coffee at 600 °C.The Initial concentration, contact time and temperature of MO solution were 10 mg/L, 25 min and 30 ºC, respectively and the dose of CG was 0.5 g. The best fit of the experimental data was obtained by the Freundlich isotherm, having an R^2 value of 0. 9652, indicating the heterogeneity of the CG and multi-layer coverage of MO onto the CG adsorbent.

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Antioxidant Potential of *Sonneratia alba* from Panjang Island, Bontang

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Abstract

The study aims were to determine the antioxidant potential and phytochemical test of Sonneratia alba leaf extract and also to test its toxicity against Artemia salina. The leaves of Sonneratia alba were collected from Panjang Island, Bontang City, East Kalimantan, and extracted using three different solvent polarity (n-Hexane, Ethyl acetate, and Methanol). The antioxidant activity was determined by the Diphenyl picryhydrazil (DPPH) method in five different concentrations (200; 300; 400; 500; and 600 ppm). The phytochemical test showed the n-hexane extract contained cardiac glycosides, saponins, flavonoids, and steroids/terpenoids, while the positive ethyl acetate extract contained alkaloid compounds, cardiac glycosides, saponins, phenols, flavonoids, tannins, and steroids/terpenoids. Furthermore, the methanol extract was identified as an alkaloid with dragendorff reagent, cardiac glycosides, saponins, phenols, tannins, and steroids / terpenoids. The antioxidant analysis showed the ethyl acetate extract had strong antioxidant potential (74.6 µg / ml) whilst the toxicity test against Artemia salina showed a toxic ability with LC_{50} was 161.3704 µg / mL.

Keywords: *Sonneratia alba, phytochemical, toxicity, Artemia salina, DPPH*

Introduction

Bontang City is one of the cities located in the coastal area of East Kalimantan Province. The city is directly adjacent to the Makassar Strait in the east, with a geographic location of 0.137 ° N and 117.5 ° East. The city of Bontang as one of the coastal areas has an area covered by mangrove forests which is spread across its coastline from the Gusung River to the Manuk-manukan area and the coral islands around it, and the total area is 2,073.32 Ha (Nurhidayah et al. 2009).

Mangroves or commonly known as mangrove forests are plants that live in the transitional area between freshwater and sea water (brackish). Mangroves are rich in benefits, both in direct contact with human life on land ranging from ecological benefits as remediation of pollutants, spawning sites, maintaining coastal stability from abrasion, to benefits as a food source where extracts and raw materials from mangrove plants have been used by coastal communities for natural medicinal purposes. The community uses mangroves as traditional medicine because it has a very high bioactive potential (Spalding et al. 2010).

Sonneratia alba mangrove is a type of coastal plant. The stem bark extract of Sonneratia alba shows high antibacterial activity and has a broad spectrum, so it has the potential to be a source of natural antibacterials and has great potential as a source of natural antioxidants (Herawati, 2009; Spalding et al. 2010). Antioxidants are compounds or substances that can inhibit, delay, prevent or slow down oxidation reactions even in small concentrations. Oxidation is a chemical reaction that can produce free radicals that can trigger a chain reaction (Ghosal et al. 1996).

Free radicals are one of the causes of various degenerative diseases such as cancer, atherosclerosis, stroke, kidney failure, hypertension, cataracts, premature aging and other chronic diseases (Saha et al. 2008; Prasad et al. 2009). Free radical activity can be reduced by administering antioxidants or consuming antioxidants (Ghosal et al. 1996; Kubola and Siriamornpun 2008; Escudero et al. 2008; Mohsen and Ammar 2009).

Based on the above, it is necessary to have further research to determine and test the potential of Sonneratia alba mangrove leaf extract from Pandjang Island, Bontang City as an antioxidant drug ingredient. Exploration of the potential of Sonneratia alba mangroves as antioxidants requires deeper research so that it can be an alternative to natural antioxidants for the community, especially coastal communities.

Materials and Methods

Time and Place of Research

The research was conducted in April-August 2019. The location for sampling was carried out in the mangrove ecosystem area on Panjang Island, Bontang City, East Kalimantan. This research was conducted at the Conservation Laboratory, F-PIK, UNMUL, Pharmacology and Phytochemical Laboratory, STIK-Samarinda. And identification of mangrove samples was carried out at the Laboratory of Plant Anatomy and Systematics, F-MIPA, UNMUL. As well as sample preparation for toxicity tests carried out at the

Water Quality Laboratory, F-PIK, UNMUL. The sampling location points can be seen in Figure 1 below.

Figure 1. Map of Research Location

Materials and Methods

The equipment used in the field are cameras, plastic samples, newspapers, label paper, stationery and GPS. While the analytical equipment in the laboratory are glass jars, freezers, spectrophotometers, digital scales, blenders, measuring cups, erlenmeyer tubes, jirgen, gloves, vials, vaporizer cups, funnels, drop / micro pipettes, test tubes, test tube racks, rods. mixer, vacuum rotary evaporator, mask, tissue, spatula and lamp.

The research raw materials were the mangrove leaves of Sonneratia alba and Artemia salina. The chemicals used for the analysis are n-hexane, ethyl acetate, methanol, DPPH, dH2O, NaOH, HCl, FeCl3, H2SO4, chloroform, dragendroff reagent, mayer reagent, bismuth nitrate, 25% ammonia, 30% nitric acid and brine.

Sampling in the field was part of the mangrove leaves of Sonneratia alba. Sampling was 10 kg wet / 1 sack of rice size 25 kg. The leaves of Sonneratia alba mangrove are fresh green leaves.

Identification of mangrove species in the field starts from first observation by looking at the fruit, leaves, stems and roots. Then it was further investigated to determine the types of mangroves in the Laboratory of Plant Anatomy and Systematics, Faculty of Mathematics and Natural Sciences, Mulawarman University.

The preparation stage is divided into 2 stages. The first is the preparation of reagents that will be used in phytochemical tests in the form of reagents: Dragendorff's, Mayer's, 10% and 25% ammonia, 1% and 10% hydrochloric acid, 5% iron chloride, 10% lead acetate, 20% sodium hydroxide. . And secondly, sample preparation.

Extraction

The extraction was carried out by means of graded maceration using n-hexane, ethyl acetate, and methanol successively (Setha et al. 2013). A sample of 500 grams of mangrove leaves was macerated in 1 L of n-hexane solution for 3x24 hours at room temperature ± 40o C, then filtered. The filtered sample was then evaporated using a rotary evaporator at 37 ° C. The residue was macerated again in ethyl acetate and methanol in the same way as above, then evaporated until a thick extract was obtained.

Phytochemical Test

The phytochemical test is a way to determine whether a plant contains boiactive compounds or not. The phytochemical test is carried out by testing and seeing the results of the following compounds:

Alkaloids

Dragendorff's test: 0.5 ml Dragendorff's reagent added 1 ml of sample. A positive test for Dragendorff's formed dark orange deposits (Madappa and Bopaiah, 2012). Mayer's test: 0.5 ml of Mayer's reagent mixed with 0.5 ml of sample. Yellow deposits indicate alkaloids (Tiwari et al. 2011).

Steroids and Terpenoids

10 ml of chloroform is mixed with 1 ml of sample solution. Then 10 ml of sulfuric acid was added slowly and carefully to get 2 layers. Reddish brown color indicates positive terpenoids. Then stirring slowly, if a reddish brown color is formed on the ring, it indicates positive steroids (Uddin et al. 2011).

Phenolic

Lead acetate test: 2 ml of 10% lead acetate was added to 1 ml of sample solution. Chocolate deposition is positive for phenol (Madappa and Bopaiah, 2012). Ferric chloride test: A few drops of 5% ferric chloride are added to 1 ml of sample solution. Dark blue or black deposits indicate positive phenols (Ugochukwu and Ifeanyi, 2013).

Flavonoids

Alkaline reagent test: 1 ml of sample solution added a few drops of 20% sodium hydroxide. The yellow deposits formed after the addition of a 1% hydrochloric acid solution indicate the presence of flavonoids (Ugochukwu and Ifeanyi, 2013). Lead acetate test: Gradually 10% lead acetate was added to 1 ml of sample solution. Yellow deposits indicate the presence of flavonoids (Bhandary et al. 2013). Ferric chloride test: A few drops of 5% ferric chloride are

mixed with 1 ml of sample solution. Blue or black deposits indicate the presence of flavonoids (Bhandary et al. 2013).

Saponins

1 ml of sample was added with 2 ml of dH2O, then shaken for 1 minute. The presence of bubbles indicates the presence of saponins (Bhandary et al. 2013; Uddin et al. 2011).

Tannins

Ferric chloride test: 2 ml of 5% ferric chloride plus 1 ml of sample. Changes in color to greenish brown or dark blue indicate positive tannins (Madappa and Bopaiah, 2012).

Cadiac Glycosides

Keller Kelliani's test: 5 ml of sample is mixed with 2 ml of glacial acetic acid and slowly drizzled with 5% ferric chloride. Add 1 ml of sulfuric acid slowly to keep the formation of two layers. The brown ring between the layers indicates the presence of deoxysugar which is a characteristic of cardenolide (Ugochukwu and Ifeanyi, 2013).

Anthocyanins

1 ml of sample solution is mixed with 5 ml of 10% hydrochloric acid. The presence of a pink color indicates a positive anthocyanin (Madappa and Bopaiah, 2012).

Toxicity Test Using the Brine Shrimp Lethality Test (BSLT) Methode

The resulting Sonneratia alba mangrove extract was subjected to a toxicity test using the BSLT method, namely to determine the toxicity level of the existing sample extract, as a reference to determine the level of sample safety. The toxicity test using the BSLT method starts from the following stages:

- Test Solution Preparation. The preparation of the test solution modified the research of Diastuti et al. (2009). The initial concentration was 1,000 µg / mL as mother liquor by dissolving 0.01 g of the extract in 100 mL acetone. Further dilution was carried out to obtain concentrations of 200, 100, 75, 50 and 25 µg / mL in a volume of 1 mL. The solution used as a control was carried out without the addition of the extract.
- Preparation of media for Artemia salina larvae. The preparation of larvae refers to research by Panggabean (1984) by paying attention to factors, such as salinity 5 - 70 ppt, DO at least 3 mg / L, pH 7- 9, temperature 28 - 35 oC. Hatching was carried out using a glass jar by immersing 1 gram of Artemia salina cyst in 500 mL of water with 15 grams of Krosok salt added and illuminated with an electric light and macerated for 24 hours.
- Toxicity Test. This toxicity test was carried out by modifying the study conducted by Sangi et al. (2012). A 10 mL vital tube was prepared, then each test solution was taken with a micropipette of 20 µg / ml. Then added water that has been mixed with 15 gr of krosok salt and 20 larvae of Artemia salina which have aged 1 day until the volume reaches 8 ml. Each concentration was repeated 3 times and compared to the control. This test was carried out for 24 hours and then the number of mortality of Artemia salina larvae was seen.

Test Antioxidant Activity Using the DPPH Methode

The method used to test for antioxidant activity is DPPH which is generally made in the form of an inhibitor concentration of 50 (IC50), namely the concentration of the substrate solution or sample that will reduce DPPH activity by 50%. The greater the IC50 value, the smaller the value of antioxidant activity (Molyneux, 2004).

The Sonneratia alba sample extract was dissolved using ethyl acetate with a concentration of 200 ppm, 300 ppm, 400 ppm, 500 ppm and 600 ppm (Maulana, 2012). Each concentration was pipette 3 ml and mixed with 1 ml of DPPH 100 µM solution (Putranti, 2013). The mixture was incubated at 30oC for 30 minutes in a dark place, then the absorbance was measured using a UV-Vis spectrophotometer at a maximum wavelength of 517 nm (Sharma and Tej, 2009).

Inhibition activity was calculated using the formula (Setha et al. 2013). The addition of DPPH solution to the extract sample caused a color change from purple to pale yellow. According to Andayani et al. (2008) the presence of antioxidant activity from the sample resulted in a color change in the DPPH solution in ethyl acetate which was originally dark purple to pale yellow. The color change that occurs can indicate the antioxidant content in the sample. The antioxidant activity test in the form of the absorbance value of the sample will be converted into a percent inhibition value. The percentage of inhibition is the percentage inhibitor of free radical activity.

Toxicity Test

The toxicity test used the BSLT method. The sample toxicity test is determined by looking at the value of the lethal Artemia salina up to 50% and statistical calculations are carried out using probit analysis (probability unit). According to Nurhayati et al. (2006), the toxicity effect was analyzed from observations by the percentage of deaths.

$$\% \text{ Mortality} = \frac{H \text{ number of dead larvae}}{H \text{ number of test larvae}} \text{ x } 100\ \%$$

The toxicity category of mangrove extracts was determined by the LC50 concentration value, as presented in Table 1.

Table 1. Values and Toxicity Categories (Meyer *et al.* 1982)

No	Values LC_{50} (µg/mL)	Toxicity Category
1	< 1000	Toxic
2	> 1000	Not Toxic

Antioxidant Test

The antioxidant activity of the sample is determined by the amount of DPPH radical absorption inhibition by calculating the percentage of DPPH absorption inhibition against the extract that has the highest activity calculated by the IC50 value (50% inhibition consentration).

$$\% \text{ inhibition} = \frac{Ac - As}{As} \text{ x } 100\ \%$$

Description: Ac = Absorbance Control, As = Absorbance Sample

Results and Discussion

Phytochemical Test

Testing the bioactive compounds of Sonneratia alba leaves was carried out by extracting phytochemical compounds using three different solvents. The use of these three solvents is based on the capabilities of each solvent and also the target compound desired. Phytochemical test results from the extract of n-hexane, ethyl acetate, and mangrove leaves of Sonneratia alba are presented in Tables 2, 3, and 4.

Phytochemical test results of Sonneratia alba mangrove leaves with n-hexan solvent were identified as positive for cardiac glycosides, saponins, flavonoids and stereoid / terpenoid compounds. Silalahi, (2006) states that flavonoids generally act as antioxidants, namely as free radical scavengers because they contain hydroxyl groups. Flavonoids are reducing agents so that they can act as hydrogen donors to free radicals. Tannin compounds according to Sudira et al. (2011) are organic compounds that actively inhibit microbial growth by damaging microbial cell walls and forming bonds with microbial cell functional proteins. However, seen from the results of the compound content, the results of the n-hexane extract contain very little bioactive compounds, this allows the effect of differences in the properties of the solvent.

Table 2. Phytochemical Test Results of Sonneratia alba Mangrove Extract with n-Hexane Solvent.

Compound Type	Phytochemical Test	Positive Reaction	Phytochemical Results
Alkaloid	Dragendorff's Test	Orange sediment	-
	Mayer's Test	Yellow sediment	-
Antosianin	Antosianin Test	Solution Pink	-
Tanin	$FeCl_3$ Test	Dark Green Solution	-
Cardiac Glycoside	Keller Kelliani's Test	Seen a Chocolate Ring	+
Saponin	Sabun Test	There are Foam Bubbles	+
Flavonoid	*Reagent* Alkaline Test	Clear Yellow	+
Steroid	Salkowski Test	Seen a reddish brown ring	+
Phenol	$FeCl_3$ Test	Dark Green Solution	-
Terpenoid	Salkowski Test	Seen a reddish brown ring	+

Information :
(+) indicates a positive result of bioactive compounds
(-) indicates a negative result for the presence of bioactive compounds

The results of the ethyl acetate extract were positively identified as secondary metabolites of the alkoloid, cadiac glycosides, saponins, phenols, flavonoids, tannins and stereoid / terpenoid compounds. This ethyl acetate extract contains phenolic compounds which, according to Dixon and Paiva (1995) simple and complex phenol compounds are the main antioxidant metabolite compounds for plants. According to Sudewo (2005), compounds that have potential as antioxidants are generally flavonoids, phenolics, and alkaloids. Flavonoid and polyphenol compounds are antioxidants, antidiabetic, anticancer, antiseptic, and anti-inflammatory, while alkaloid compounds inhibit the growth of cancer cells. It is possible that the ethyl acetate extract of Sonneratia alba mangrove leaves has high antioxidant activity because there are several components of the main antioxidant compound.

Table 3. Phytochemical Test Results of Sonneratia alba Mangrove Extract with Ethyl Acetate as solvent.

Compound Type	Phytochemical Test	Positive Reaction	Phytochemical Results
Alkaloid	Dragendorff's Test	Orange sediment	+
	Mayer's Test	Yellow sediment	+
Antosianin	Antosianin Test	Solution Pink	-
Tanin	$FeCl_3$ Test	Dark Green Solution	+
Cardiac glycoside	Keller Kelliani's Test	Seen a Chocolate Ring	+
Saponin	Sabun Test	There are Foam Bubbles	+
Flavonoid	*Reagent* Alkaline Test	Clear Yellow	+
Steroid	Salkowski Test	Seen a reddish brown ring	+
Phenol	$FeCl_3$ Test	Dark Green Solution	+
Terpenoid	Salkowski Test	Seen a reddish brown ring	+

Information :
(+) indicates a positive result of bioactive compounds
(-) indicates a negative result for the presence of bioactive compounds

Whereas in the Methanol extract, compounds of the alkoloid, cardiac glycosides, saponins, phenols, tannins and stereoid / terpenoids were identified. The results of the phytochemical test of Sonneratia alba have the same results as the research of Raut and Anthapan (2013) which states that the qualitative test results of the Methanol extract of Sonneratia alba leaves are positive for containing alkaloids with dragendroff reagents, saponins and tannins. Alkaloids work as antibacterials by interacting with cell walls which can lead to cell wall damage. Alkaloids can also bind to bacterial DNA causing failure of protein synthesis (Cowan, 1999).

Toxicity of Sonneratia alba Mangrove Leaf Extract

Based on the results of the phytochemical test of Sonneratia alba mangrove extract with various solvents (Tables 5, 6, 7) and seeing the potential of the active compound, it was continued to the BSLT test using Artemia salina larvae to see and determine the toxicity of these compounds. The most potential extract based on the results of the phytochemical test was Ethyl Acetate extract. Ethyl Acetate extract contains alkoloid compounds, cardiac glycosides, saponins, phenols, flavonoids, tannins and stereoids / terpenoids.

Table 4. Phytochemical Test Results of Sonneratia alba Mangrove Extract with Methanol Solvent.

Compound Type	Phytochemical Test	Positive Reaction	Phytochemical Results
Alkaloid	Dragendorff's Test	Orange sediment	+
	Mayer's Test	Yellow sediment	-
Antosianin	Antosianin Test	Solution Pink	-
Tanin	$FeCl_3$ Test	Dark Green Solution	+
Cardiac glycoside	Keller Kelliani's Test	Seen a Chocolate Ring	+
Saponin	Sabun Test	There are Foam Bubbles	+
Flavonoid	*Reagent* Alkaline Test	Clear Yellow	-
Steroid	Salkowski Test	Seen a reddish brown ring	+
Phenol	$FeCl_3$ Test	Dark Green Solution	+
Terpenoid	Salkowski Test	Seen a reddish brown ring	+

Information :
(+) indicates a positive result of bioactive compounds
(-) indicates a negative result for the presence of bioactive compounds

The toxicity test results of Ethyl Acetate extract on Artemia salina are shown in the following table:

Table 5. LC50 values of Artemia salina Leach

Conct.	Death Rate			Mortality			Score LC_{50} (µg/ mL)
	1	2	3	1	2	3	
200 ppm	10	11	14	0,5	0,55	0,7	161,3704
100 ppm	9	7	7	0,45	0,35	0,35	
75 ppm	8	7	8	0,4	0,35	0,4	
50 ppm	6	7	7	0,3	0,35	0,35	
25 ppm	5	6	6	0,25	0,3	0,3	

The results from Table 8 show that the higher the concentration, the greater the percentage of mortality (death) so that the probit value is also higher. This is because the way the compounds contained in the sample work, namely the extract can kill the larvae of Artemia salina Leach shrimp. Artemia salina Leach, acts as stomach poison or stomach poisoning, therefore when these compounds enter the body of the larva, the digestive tract will be disturbed. In addition, this compound will inhibit the taste receptors in the mouth area of the larvae. This results in the larvae failing to get a taste stimulus so that they are unable to recognize their food and the larvae die of hunger (Muaja, 2013). According to Puspita et al. (2018)

Sonneratia alba has strong toxic properties on the leaves. Sonneratia alba is a mangrove plant that belongs to the Sonneratiaceae family. The toxic properties owned by the Sonneratiaceae family come from the biocative compounds contained in it such as tannins, alkaloids and flavonoids. This was also proven by the results of the research on the content of bioactive compounds that the etic acetate extract of Sonneratia alba mangrove leaves was positive for tannin compounds.

According to Sudira et al. (2011) stated that tannin compounds are organic compounds that actively inhibit microbial growth by damaging microbial cell walls and forming bonds with microbial cell functional proteins. According to Bandaranayake (2002) in Herawati et al. (2009) also stated that tannins are one of the polyphenolic compounds found in the mangrove plants of the Avicenniaceae, Rhizophoracee, and Sonneratiaceae families.

Based on the results of observations during testing the median value of Lethal Concentration 50% (LC50) of the Ethyl Acetate extract of Sonneratia alba mangrove leaves was 161.3704 µg / mL. From the value obtained, the Ethyl Asestat extract of Sonneratia alba mangrove leaves was categorized as toxic to Artemia salina. The values and toxicity categories obtained follow the reference by Meyer et al. (1982), that if the LC50 value <1000 µg / mL can be categorized as toxic and vice versa if> 1000 is categorized as non-toxic. This is in accordance with the research of Nuraini and Noerbaeti (2017) that the mangrove leaf extract of Sonneratia alba has toxic properties with immersion concentrations of 70 ppm, 80 ppm, 90 ppm and 100 ppm which have potential as bacteriocides against Vibrio fluvialis, Vibrio alginolyticus and Vibrio parahaemolyticu.

Antioxidant Activity Using the DPPH Methodes

The results of the analysis of DPPH antioxidant activity from the Ethyl Acetate extract of Sonneratia alba mangrove leaves can be seen in Table6.

The value obtained from the calculation results shows that the IC50 of the ethyl acetate extract of Sonneratia alba mangrove leaves is 74.61 ppm. Several studies have also found that mangroves have antioxidant activity using the same solvent.

According to Kusyana (2014) on young leaves of mangrove Sonneratia alba antioxidant activity of 37.43 ppm, old leaves of 49.77 ppm and fruit of 39.30 ppm. Herawati et al. (2011) also suggested that the stem bark of Sonneratia alba has antioxidant activity of 12.2 ppm and Paputungan et al. (2017) the antioxidant activity of Sonneratia alba fruit was 296.54 ppm. Meanwhile, according to Asha et al. (2012) on the roots of Rizhopora apiculata the antioxidant activity of 11.4 ppm and the roots of Acanthus allicifolius at 27.6 ppm.

The results of this study indicate that the ethyl acetate extract of Sonneratia alba mangrove leaves has antioxidant potential and is categorized as strong. As stated by Molyneux (2004) in Purwaningsih et al. (2013) stated that the value of IC50 <50 ppm is a very strong antioxidant, IC50 = 50-100 ppm is strong, 100-150 ppm is moderate, 150-200 ppm is weak and IC50> 200 ppm is categorized as very weak. This is because mangroves have the characteristics and species composition of each mangrove forest which is influenced by weather factors, coastal land forms, the distance between the tides, water availability, oxygen and soil type (LPP Mangrove, 2006).

Table 6. Antioxidant Activity of *Sonneratia alba* Mangrove Leaf Extract

Conct. (ppm)	Absorbance and Deuteronomy			% Inhibition			Average	IC_{50} (µg/ mL)
	U1	U2	U3	U1	U2	U3		
200	0,3128	0,3055	0,3066	0,4485	0,2507	0,4641	0,387796	74,60179
300	0,2617	0,2554	0,2617	0,1952	0,1961	0,1715	0,187665	
400	0,2182	0,2122	0,2208	0,1993	0,2035	0,1852	0,196058	
500	0,1746	0,1701	0,1805	0,2497	0,2475	0,2232	0,240161	
600	0,1457	0,1368	0,1497	0,1983	0,2434	0,2057	0,21584	

Conclusions

Based on the research results that have been described, it can be concluded as follows:

1. The results of the bioactive compounds of the Sonneratia alba leaf extract in the n-hexan extract were identified as positive for cardiac glycosides, saponins, flavonoids and stereoid / terpenoids. Ethyl acetate extract positively contains alkoloid compounds, cardiac glycosides, saponins, phenols, flavonoids, tannins and stereoid / terpenoids. While the methanol extract was identified as an alkoloid with dragendorff reagent, cardiac glycosides, saponins, phenols, tannins and stereoids / terpenoids.
2. The toxicity value of LC50 (Median Lethal Consentration) of Ethyl acetate extract of Sonneratia alba mangrove leaves against Artemia salina Leach was 161.3704 µg / mL. This value is categorized that the mangrove extract has toxic properties.
3. Ethyl acetate extract of Sonneratia alba mangrove leaves has a strong antioxidant potential with an IC50 value (50% inhibition consentration) of 74.61 ppm.

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Pb Content in Blue Swimmer Crab (*Portunus Pelagicus*) in Balikpapan Bay Waters, East Kalimantan

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Abstract

Seagrasses in Balikpapan Bay have been indicated to accumulate heavy metals in the levels that exceeded the threshold. Therefore they are potential to transfer the heavy metals to other inhabitant organisms, including Blue Swimming Crab (Portunus pelagicus). This study aims to determine the Pb content of P. pelagicus collected from the seagrass beds in Balikpapan Bay, East Kalimantan. This research was conducted in January 2020. As many as 20 crabs (± 61.66-167.24 gr/individual) were collected from two (2) different sites of seagrass beds. The crabs were dry destructed prior Pb analysis using Atomic Absorption Spectrofotometric (AAS). The results showed that the Pb content was higher at Station 2, namely 5.41 mgkg^{-1} and lower at Station 1, namely 4.45 mgkg^{-1}. According to SNI No. 7387 of 2009 the Pb content of the crabs from both stations had exceeded the maximum threshold of Pb contamination in food (0.5-2 mgkg^{-1}).

Keywords: *heavy metal, lead, Portunus, seagrass bed, small crab*

Introduction

Balikpapan Bay is surrounded by various anthropogenic activities, such as industry, ports, markets, hotels, settlements, as well as being a sea transportation route. This activity has the potential to cause high pollution problems in the waters of Balikpapan Bay which can endanger the life of the biota that inhabit these waters. Pollution that enters, such as heavy metals, can accumulate in the bodies of organisms in these waters so that it can eventually damage the ecosystem in the waters of Balikpapan Bay.

Several ecosystems in the waters of Balikpapan Bay, among others, are mangroves, coral reefs and seagrass, which provide habitat for various organisms, such as crabs (*Portunus.pelagicus).* If the habitat is polluted, it can affect the biota that lives in it. Research conducted by Anisa (2019) showes that seagrass in Balikpapan Bay has accumulated heavy metals in concentrations that have exceeded the quality standard.

Accumulation of heavy metals in seagrass can lead to the transfer of heavy metals to organisms that inhabit the seagrass habitat through the biomagnification process. Some of the effects of heavy metals when accumulated by organisms, among others, cause tissue damage, especially in sensitive organs such as gills and intestines, then to inner tissues such as liver and kidney where these metals accumulate (Darmono, 2001).

The crab is one of the important commodities of Balikpapan Bay which has economic and ecological value. The local people sell crabs to be marketed in traditional markets around the area. Crabs are organisms that easily accumulate heavy metals in their bodies because of their habit of living at the bottom of the water so that if eaten by humans it can be dangerous. According to Widowati (2008), from several aquatic biota that can accumulate Pb metal, the highest groups are shellfish (Mollusca) and crustaceans (Krustacea) with an average Pb content of 0.25 mg / g.

The most dangerous heavy metal wastes can cause toxic effects for humans (Boran and Altinok, 2010). Heavy metal is a toxic metal that is dangerous when it enters the body beyond its threshold (Ashraf, 2006). Heavy metals when they enter the body's tissues cause anemia, damage to the nervous system, kidneys, disruption of the reproductive system, decreased IQ, and affect the absorption of substances by bone for growth, and can stimulate the birth of premature babies (Philips 1993 in Nuhman 2003).

Materials and Methods

This research was conducted in January 2020 in the waters of Balikpapan Bay, Balikpapan City, East Kalimantan Province. It has a geographic location of 116042'-116050 'East Longitude and 10-1022' South Latitude.

The sampling station consists of two, which are determined based on the purposive sampling method. The two stations are in the seagrass area, which is the habitat for the crabs.

Station 1 is an area adjacent to the Balikpapan-Penajam ferry flow, while Station 2 is adjacent to the mangrove ecosystem.

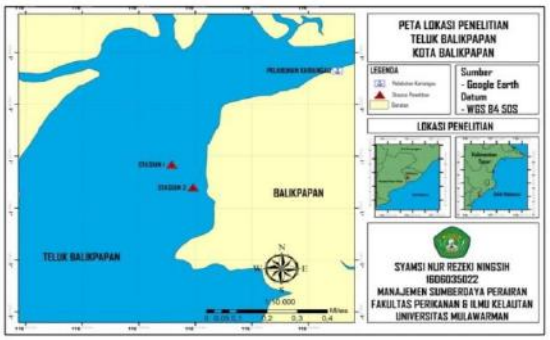

Figure 1. Map of Research Location of the Waters of Balikpapan Bay

The number of *P. pelagicus* samples used was 20 individuals which were then separated between the gills and the meat. Water samples were taken using 2 liter bottles. The parameters analyzed were: temperature, dissolved oxygen, brightness, direction and velocity of the current (insitu), and turbidity, TSS, salinity, pH (exitu). Sediment sampling was done using Eckman grab and analyzed for texture and heavy metal content. Samples of *P. pelagicus* were collected using a trap net. The rear is installed in several parts of the seagrass bed in accordance with a predetermined station. Samples of *P. pelagicus* that have been taken are immediately preserved using ice cubes to be brought to the laboratory. The meat and gills of *Portunus pelagicus* which have been separated are dry digestion to obtain the extract solution. The solution was then analyzed for Pb levels using Atomic Absorption Spectrophotometer (AAS). The Pb data obtained were analyzed using the t-test to see the significance of Pb levels in the gills and crab meat.

Results and Discussion

In general, the Pb content in gills was higher than in meat, where the Pb content in the gills ranged from 6.24 - 8.65 mgkg-^{1}, while the Pb content in the meat ranged from 2.17 - 2.67 mgkg-^{1}. Gills Pb concentration at Station 1 was lower than Station 2, while meat Pb concentration at Station 1 was lower than at Station 2. Statistical tests showed that the Pb concentration in gills was significantly different ($p \leq 0.05$) from *P. pelagicus* meat. Meanwhile, the Pb content of gills at Station 2 was significantly higher than Station 1.In contrast, the Pb content of meat at Station 1 was significantly higher than Station 2.

The higher Pb in gills than in meat is a common thing due to the direct contact of the gills to the medium, namely water (Samsundari and Perwira, 2011). Most of the toxins enter through the gills and then carried by the bloodstream and are absorbed and carried to the hepatopancreas. Studies of physiological, histological and ultra-structural activity in crustaceans show that heavy metal ions affect respiration and osmoregulation by damaging the gill cell structure (Yudiarti, *et al*., 2009). Meat is a tissue that is not active in accumulating heavy metals. The lower concentration of Pb in meat is related to the physiological role in fish metabolism (Khaled, 2004).

The content of heavy metals in *P. pelagicus* can be influenced by the nature or way of life that does little movement or live permanently and obtains its food by means of "scavenger, deposit feeder, and filter feeder", so that it can accumulate metals deposited on the base of the substrate (Mukhtasor). , 2007). The food chain can increase the content of heavy metals in biology (biomagnification), so that very high concentrations will be found in the last consumer food chain. Heavy metals that are accumulated by crabs come from water that enters their bodies, sediment, and plankton which is the food of *P. pelagicus* (Lasut, 2001).

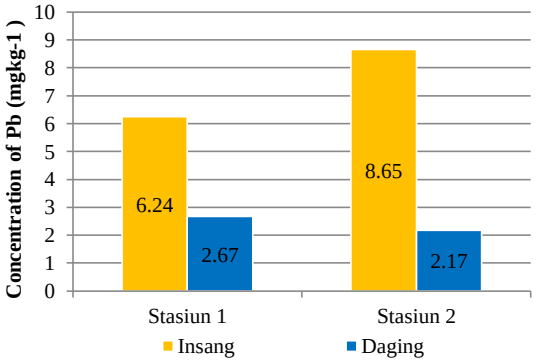

Figure 2. Average Pb Concentrations in *P. pelagicus* gills and flesh

High temperatures affect dissolved oxygen and heavy metals in the water. According to Arief Happy R, et al in Hutagalung (1984), an increase in temperature will not only increase the metabolism of aquatic biota, but also increase the toxicity of heavy metals in waters. Low dissolved oxygen levels in the waters cause an increase in the respiration rate of organisms with increased respiration, heavy metals in the water are easier to enter the body of the organism.

Crabs are active animals, but when they are not active or when they are not moving, crabs will stay at the bottom of the water at a depth of 35 meters or immerse themselves in the sand in muddy coastal areas, mangroves, rocks or can be seen swimming near the surface. The content of heavy metals in *P. pelagicus* can be influenced by the nature or way of life that does little movement or live permanently and obtains its food by means of "scavangers, deposit feeders, and filter feeders", so that it can accumulate metals deposited on the base of the substrate (Mukhtasor,

2007). Heavy metals that are accumulated by crabs come from water that enters their bodies, sediments, and plankton which feeds *P. pelagicus* (Lasut, 2001). The food chain increases the content of heavy metals biologically (biomagnification), so that very high concentrations will be found in the last consumer food chain.

Table 1. Analysis of Water Quality Parameters at the Two Research Stations

Parameter	Stations	Measurement results		Quality standards
		Stations 1	Stations 2	
Temperature	^{0}C	31	30	28-30*
Dissolved Oxygen	mg/l	4.16	4.48	>5*
Brightness	M	0.86	0.86	>3*
Continued Table 1.				
Turbidity	NTU	13.145	9.505	<5*
TSS	mg/l	28.2	28	20*
Salinity	$^0/_{00}$	34	33	33-34*
pH		7.62	7.67	7-8.5*
Flow Velocity	m/s	1.15	1.15	
Substrate		Sandy loam	Sandy loam	
Pb water		0.1491	0.1259	
Description	(*) =	Quality Standards of KEPMEN LH No. 51 of 2004		

The concentration of Pb in water at the two research stations ranged from 0.1259-0.1491 mgL-^{1} based on the quality standard of KEPMEN LH No. 51 of 2004 the concentration of Pb in water has exceeded the quality standard, namely 0.008 mgL-^{1}. Heavy metals in waters are the main types of pollutants that threaten the life of invertebrates, fish and humans and cause adverse effects that disrupt the ecological balance of the environment and the diversity of aquatic organisms (Atici *et al.*, 2008). The higher Pb concentration at Station 1 is thought to be influenced by fishing boat activity and boat traffic aimed at Balikpapan-Penajam. The fuel used for motorized vessels is added with tetraethyl which contains Pb. Tetraethyl substance is a liquid with a density of 1,659 g / cc and dissolves in gasoline. To get a high octane number, an octane lever is added, namely tetra etyhl lead $(C_2H_5)_4$ Pb which aims as an anti-knock on the machine. The results of Pb waste discharges in the waters cause Pb levels in the waters to be high (Rochyatun *et al*., 2006). The high Pb in the waters causes the accumulation of Pb in aquatic biota.

Pb Concentration in Sediment

Koneniewski & Neugabieur (1991) in Amin (2002), suggest that the type of sediment can affect the heavy metal content in the sediment, with the category of heavy metal content in mud> sandy mud> sandy. The type of sediment at the research station is sand loam with a higher percentage of sand at both stations. The large size of the sand particles causes the metal accumulation of Pb in the sediment to be lower. The Pb concentration in the sediments at the two research stations was obtained from 1,413-2,186 mg / kg-^{1}.

Table 2. Particle Distribution at Research Station

Station	Particle Spread (%)			Texture	Pb Sediment (mg/kg)
	Clay	Dust	Sand		
Station 1	14.26	14.98	70.77	*Sand Loam*	2.186
Station 2	14.28	2.48	83.23	*Sand Loam*	1.413

The Pb concentration was higher at Station 1. According to the 1997 IADC / CEDA the quality standard of Pb in sediments was 85 mg / kg so that the Pb in the two research stations was still in the low category. The low Pb concentration in the sediment is influenced by the high percentage of sand at the two research stations. The large sand grains cause the accumulation of Pb in the sediment to be low. However, according to Mance in Supriyatini and Endarawati (2015), the heavy metal content in the sediment is much higher than that in the water column, because the heavy metals that enter will be absorbed by suspended particles.

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Participation of Local People in Mangrove Conservation Effort: A Case Study from Margomulyo Mangrove Conservation Area, East Kalimantan, Indonesia

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Abstract

A challenge for managing government-owned mangrove conservation area by taking into account the attitudes of local people, mainly living near the site and in the context of heterogeneity, has rarely been considered. This study aims to understand the local people's attitudes through their participation in conservation effort conducted in MMCA (Margomulyo Mangrove Conservation Area) by using a qualitative approach. Interviewed were held with 96 of local people from four household associations contiguous conservation area by considering the socioeconomic (age, occupation, income, education) and ethnicity characteristics. The social dynamics that related to the involvement in conservation activities were a part of an observation. This study revealed that local people have positive attitudes towards conservation effort, notwithstanding that not all of them participate due to limited access to such activities; only to a member of the peasant group that cooperates with the government. A strong social relation contributes to the involvement and cooperation of local people in conservation activities, mainly in planting. Local people exhibit different factors for their participation that attached to their occupation and ethnicity characteristics. The finding of this study is essential for the government to implement the appropriate management that equitable for local people by considering their social dynamics.

Keywords: *Local people, Participation, Social Dynamics, Mangrove Conservation.*

Introduction

The problem of mangrove forest degradation worldwide has been engaged with human activities (Romañach et al., 2018). Indonesia – that has the most extensive mangroves area in the world; around 3,1 million hectares/ha (FAO, 2007) – confronts mangrove degradation problem mainly from aquaculture activities (shrimp ponds/*tambak*) (van Oudenhoven et al., 2015). The extreme loss of mangrove forest of approximately 300.000 hectares (ha) due to *tambak* expansion occurred in East Kalimantan province that recorded from 1998 to 2001 (Ilman et al., 2016). This activity is predicted to keep the major driver for mangrove degradation in Indonesia and all at once as a matter to encourage conservation effort in the remained and destructed mangrove forest (Ilman et al., 2016; Romañach et al., 2018).

In MMCA (Margomulyo Mangrove Conservation Area), Balikpapan City, East Kalimantan, the local government encourages such effort since the designation as a protected area in 2004. This area is managed by the Environmental Agency of Balikpapan City (*Dinas Lingkungan Hidup/DLH*) under conservation policies. By this status, local people living adjacent to this area, particularly those depending on their livelihood in this area, such as fishermen and shrimp/crab catchers, no longer have access to the area.

In spite of restriction, *DLH* allowed the local people to participate in the conservation project although limited in numbers. The social dynamics as the heterogeneous society (socioeconomic and ethnicity) were attributed to the level of connections with the government to access the activities.

These conditions remained a challenge for the successfulness of conservation activities, as the support from local people serves one factor (Roy, 2014; Triyanti et al., 2017). Therefore, the attitudes of local people that refer to the behavior, either positive or negative towards the efforts, derived from perceptions and experience (Badola et al., 2012) become essential to understand, especially who are living adjacent the area of conservation. Several studies that discussed mangrove forest conservation along with its management model highlighted the important of local people's participation (Bennett & Dearden, 2014; Roy, 2016; Damastuti & de Groot, 2017; Triyanti et al., 2017) as their attitudes embodied towards conservation activities as well as the management implemented. However, few of the studies focused on the local people's participation by taking into account the heterogeneity of society and limited access towards the activities under the government's management (Armitage, 2002; Bennett

& Dearden, 2014; Lamsal et al., 2015; Simarmata, 2012). In addition to it, the context of MMCA is absent. The objective of this study was to understand the local people's participation in conservation activities conducted in MMCA and the reasons that influence their participation. Thus, this study addressed the following research questions: how do local people participate in mangrove conservation activities, and what kind of reasons that drive their participation?

Materials and Methods

The study area

The study was conducted in the Margomulyo sub-urban village, Balikpapan City, East Kalimantan, Indonesia, where MMCA was located. Four household associations or *Rukun Tetangga/RT* neighbouring the MMCA were selected. These RTs were likewise the locations where the local people were characterized heterogenous as the mangrove resources users and not as well as the diverse socioeconomic and ethnic background in society.

Data collection

This study used qualitative approach. Primary data were collected through interviews of local people from four *RTs* (96 interviewees). The interviews included the questions on socio-economic (age, occupation, income, education) and ethnicity characteristics. The key informants were selected from the head of each *RT* at getting information on conservation area and the activities, local people's involvement in activities, and social dynamics in society. Observation to the conservation that was held in MMCA and the social dynamics in society was likewise used. In addition, collecting document of mangrove conservation group and *DLH* Balikpapan completed the method used in this study.

Data analysis

Analysis towards the interviews transcripts was conducted by using Atlas.ti qualitative research software. Inductive fashion approach (Thomas, 2006) was used to interpret the raw data from interviews through coding process (first cycle coding by using descriptive coding and attribute coding) then generated theme: participation (second coding by using pattern coding). The characteristics of interviewees were coded through attribute coding. Specifically, income characteristic was categorised as middle income and low income, and ethnicity characteristic was categorised as Javanese and Buginese people.

Results and Discussion

Characteristics of interviewees

Findings on the socioeconomic and ethnicity characteristics through the attribute coding process showed that local people were heterogeneous, as presented in Table 1.

Table 1. Socioeconomic characteristics of the interviewees

Characteristics	Description	Number
Age	30-39	31
	40-49	34
	50-59	23
	60+	8
Occupation	Fisherman	44
	Shrimp/crab catcher	10
	Laborer	18
	Worker	11
	Civil servant	2
	Others	11
Income level categories	Middle income	69
	Low income	27
Education level	No school	11
	Primary school	26
	Junior high school	31
	Senior high school	27
	College	1
Ethnicity	Javanese	46
	Buginese	50

Note: Category of income adapted from World Bank's threshold of income on 2019 (July). Middle income: 1,026 USD-12,374 USD (1,222 million Rupiahs-14,748 million Rupiahs). Low income: <1,026 USD (<1,222 million Rupiahs)

In occupation type, local people engaged with the various main sources of income. Fishing was the dominant livelihood activity for local people (44 interviewees). Based on the observation, the area of river banks and mangrove forest were basically the main support for economic activities of fishermen, either the fish to consume with family or to sell. Conversely, the local people harvested the shrimp or crab, they sell it as majority for fishing purpose. In addition to it, it was a typical livelihood of Javanese people. Both occupations were directly related to the mangrove forest resource use. Laborer and worker (i.e., employees or private business) are other main

income sources for local people that were not have relation with mangrove resources.

The income level consisted of middle-income level ranged from 1,2 million Rupiahs to five million rupiahs, and low-income level earning less than 1,2 million Rupiahs. Mostly of them (69 interviewees) were in the middle-income category. Level of education showed that local people have different background covered from no education background to graduate in bachelor level. These characteristics were associated to the participation of local people in conservation (Badola et al., 2012).

Similar to income level, ethnicity was categorized into two ethnics; Javanese and Buginese people. Both were the dominant local people and identically the mangrove forest resources users. Scattered throughout four RT, Javanese dominate the population followed by Buginese. Lamsal et al. (2015) and Karmakar (2018) found that local people living along side of mangrove forest area and depend to the mangrove forest can be identified by ethnic background.

Local people's participation in mangrove conservation activities

Local people showed a positive attitude towards conservation activities held in MMCA although the lack of access towards the activities. They demonstrated such attitude in two kinds of participation. First, participation through memberships of a mangrove group that cooperate with *DLH* to execute the activities. Second, participation in terms of experience at the first conservation activities implemented in MMCA. Participation of local people was engaged with activities in nurseries, planting, maintenance, and supervision.

The former was related to local people's participation as members of the mangrove group, namely the peasant group "*Tepian Manunggal Abadi*". The official members included six people, who were the leader, secretary, treasurer, and members. This group was officially had legal standing in 2018 since DLH changed the management model to CSR (Corporate Social Responsibility) programs, which meant the conservation project was open to the third parties and required the legal group status to execute the project. Previously, local people accessed the projects through peasant groups that were established in each *RT*. Presently, "*Tepian Manunggal Abadi*" was the only group executing the conservation projects in MMCA from the third parties' CSR. For instance, a conservation project of 10.000 mangrove seedling planting by oil and gas company *PERTAMINA* during period 2016-2020. Such a management model implemented by DLH officials resulted in a limited number of local people engaged in conservation.

Interviewees who participated in conservation with the group member status came from different characteristics. These were not only revealed their background and social relations in society. Besides, social relations with the government allowed them to have access to the activities, as shown in Table 2.
Table 2. Local people as the member of mangrove conservation group and the activities

Regarding the group's position, the leader was a fisherman and a guardian of the conservation area. He has a higher education background compared to other members, a Javanese, and his income was included in a middle category. The results of the interviews of the leader showed that officials of *DLH* advocated him to lead the mangrove group which was agreed by other members. He likewise inhabited RT 42, which was the nearest location to the conservation area; the main reason he was chosen as the guardian by officials of *DLH*. Also, he was likewise elected by members as this group was the new form of former peasant group "*Tepian Lestari* "that organized by Javanese fisherman.
Three interviewees revealed that they participated as a member of the group and they occupied the position of treasurer and member. The treasurer and another member were fishermen, a middle-income category, and Buginese. Both similarly admitted that their memberships in the present group were continuing the former group's membership status, namely peasant group "*Tepian Lestari*" before it was changed into "*Tepian Manunggal Abadi*."

"The initiator (establishment of mangrove group) came from fishermen. The former group disbanded, now is a new group…That means the members of mangrove majority are fishermen" (Interview, treasurer of mangrove group, 12/2/2019)

According to the treasurer, the former group was initiated by a Javanese fisherman, and he persuaded other fishermen to support the preservation of mangrove forests. The Buginese fishermen joined the activities as the closeness feeling as fishermen.
Another member was a laborer, the only one who have a low-income background, and Buginese. All of these Buginese members lived at RT 41 that was well known as fishermen inhabitation. According to the Buginese treasurer, he allowed the Buginese laborer to have access as a member since they have a good relationship, and he came from a fisherman family.

Table 2. Characteristics of Local People

No	Position in the group	Characteristics	RT	Type of activities	Time duration
1.	Leader	Fisherman, MMCA guardian, 40 years old, middle income, senior high school, Javanese.	42	Nursery, planting, maintenance, supervision	No regular time
2.	Treasurer	Fisherman, 55 years old, middle income, elementary school, Buginese	41	Nursery, planting, maintenance, supervision	No regular time
3.	Member	Fisherman, 59 years old, middle income, junior high school, Buginese	41	Planting, maintenance, supervision	No regular time
4.	Member	Laborer, 37 years old, low income, elementary school, Buginese	41	Planting, maintenance, supervision	No regular time

The type of relationships was diverse from each other; their relatives and similar occupation as a fisherman. The type of relationships as a fisherman

could not be separated from the background of establishing this group, which was initiated by fishermen. These types of relationships that attributed to the member was common as can be seen in the mangrove group recruitment in other places (Nath & Inoue, 2010).

In this study, participation involved several processes from decision-making, implementing, benefit sharing, and evaluating (Islam et al., 2013). Members of the group were involved by *DLH* officials in all process. It was not a similar condition with the mangrove groups in four villages in Central Java based on the study from Damastuti & de Groot (2017) that the government implemented one way decision to the conservation project.

Furthermore, although voluntary participation previously initiated this group's establishment, the budget of the project allocated the wage for the participants, particularly in planting. Based on the treasurer information, each of the local people participates in planting got a wage of roughly 100 thousand Rupiah. Members of the group, in certain circumstances, needed additional participants to participate in planting projects. According to the treasurer, they have volunteers outside of the group; they were their relatives and have occupation background as fisherman. Yet, they yielded incentives for their labor. The practice of incentive beneficiaries instead of pure voluntary seems appeared in many conservation projects in Indonesia. Non-members were engaged when the activities need additional labor that potentially emerges conflict within and outside of the group, particularly when incentives were involved (Damastuti & de Groot, 2017).

There were slight differences among members related to their activities, notably in nurseries that only leader and treasurer undertook it. The leader interviews results showed that the opportunity of conducting mangrove nurseries is substantial since his status as a guardian allowed him to has direct access to Margomulyo conservation areas as well as knowledge and skill of mangrove conservation. Meanwhile, the treasurer interviewees stated that past experiences in the former group give him skill and knowledge about mangrove nurseries. His close relations with the leader allowed him to continue the nurseries, which were conducted since joining the former group. Two other interviewees who were member of the group did not participate in nurseries. The interviews findings were confirmed by observation in which the leader conducted his nurseries in front of his house. In contrast, the Buginese treasurer has mangrove seeds behind his house. They prepared mangrove seedlings for the conservation projects.

Based on the conditions described above, local people participate through mangrove groups' memberships were associated with their socio-economic and ethnicity. In particular, occupation background that directly related to the conservation area was the potential status to have open access to the conservation activities and connections with the government officials. The leader showed this relation compared to other members. However, the group's heterogeneity condition indicated that social dynamics allowed local people with different socioeconomic and ethnic backgrounds to participate, although social position and status context was potentially identified by ethnic background.

The latter, regarding participation in terms of experience in the conservation activities, particularly in the beginning project of conservation in MMCA. In 2012, the first planting project of 50.000 mangrove seedlings involved local people living around mangrove forests, particularly from four *RT* neighboring the area. Local people mainly experienced in planting activities, as shown in Figure 1. as well indicated based on their ethnic background.

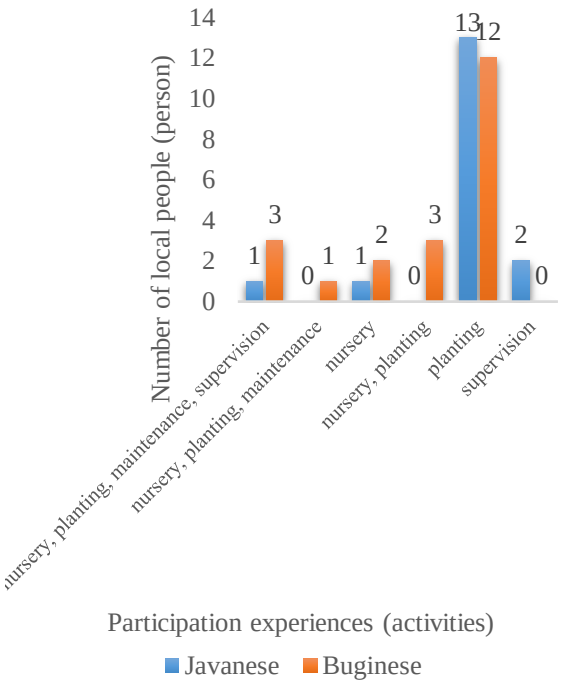

Figure 1. Participation experience of local people (outside of mangrove group)

Despite the local people dominant experienced in planting, one Javanese and three Buginese people experienced in four activities. It also showed the Buginese people predominantly hold experience in only mangrove nurseries. They expressed that they got the income benefit from this activity when they were selling the seedling for the planting project. In contrast, Javanese rarely participated in nurseries since they were more involved in planting. Conversely, two Javanese interviewees had experience in supervision. They were voluntarily involved in this activity as own-initiative and part of support to government effort to sustain the mangrove forest although they were outside of the mangrove group.

The conservation activities involved different characteristics of the local people at that time. In particular, local people with the occupation background that directly linked with mangrove forest and not, they participated. The occupation background of local people who have experiences in conservation that categorized based on ethnicity was identified in this study. Most of the local people who have experience in conservation activities were fishermen from Javanese and Buginese people (23 interviewees). A study from Arnez (2018) showed that Buginese fishermen activities in the border of the mangrove conservation area in Margomulyo are observable. Hereafter was Javanese shrimp/crab catchers and the Buginese laborers. The first and the second occupations indicated that the local people who have such livelihoods were more pertinent to mangrove forest conservation efforts.

Although the chance for local people outside of the group to participate was likely difficult under present management and the exclusion of the mangrove group, local people who experienced in the conservation project before admitted that they still support the activities. Local people worked collectively as so-called *gotong royong* to maintain their settlement area's cleanness, which was the edge of the conservation area. They also voluntarily helped the supervision of the mangrove conservation area. As expressed by interviewees living at RT 42 which his house was closest to the conservation area:

"I supervised the area since the beginning of this area open. This is my self-initiative. We usually also join for cleaning the garbage in the area (conservation)" (interviews, shrimp catcher, Javanese informant 19, 16/3/2019).

The initiative to participate was encouraged to maintain a good social relation even though they cannot access the planting project. Besides, how the social relations intertwined among local people based on the good social networks made them still connected with mangrove groups that potentially brought them to participate in conservation activities. Furthermore, although there was a complaint about the limited access to the project, local people chose to establish a fishermen group to connect with the government instead of competing with a mangrove group. They support conservation by obeying the regulations regarding the prohibition to enter the conservation area for fishings. In contrast to previous findings (Armitage, 2002; Johnson & Forsyth, 2002), no evidence of the differentiated characteristic, particularly by occupation and ethnicity, exclusively has access to the mangrove forest and conservation activities were detected in this study. Conversely, this study supports evidence from previous observations (e.g. Suharti et al., 2016; Karmakar 2018).

Reason for participating in mangrove conservation activities

Findings regarding the reason for participating in conservation activities showed the differences among members of the mangrove group, notwithstanding they have access to the activities. The leader of the group from Javanese fisherman expressed his occupational background as the guardian of mangrove conservation. This occupation at the same time caused the responsibility to participate. His strong connection to the officials of *DLH* enhanced the level of participation. Meanwhile, two members of Buginese (treasurer and member) admitted that

they have awareness toward mangrove forests since their involvement in conservation activities before this area was under government management. They joined in the former group initiated by a Javanese fisherman. Their background occupation as a fisherman that directly attached to the mangrove forest initiated their awareness. The interviews result with one of the members was showed:

"I am a member of mangrove conservation group since 2000 and active until now. The active member around six people, and others only when they have time. I definitely want to join (the activities) because it is part of my awareness and my responsibility as the local people settle in here. If is not so, our forest will be loss" (interviews, member of mangrove group, fishermen, Buginese, 27/3/2019).

They similarly showed that, in fact, their participation received the benefit of income as well. They were getting paid instead of voluntary; as their activities required human power and in long time duration. It was revealed that their participation was intertwined with social dynamics as a heterogeneous society. For those reasons, it can be said that factors of occupations related to mangrove forest, knowledge, and skill from experience in conservations, and benefit received were the factors of local people (member) to participate. These factors were explained differently by members identified through their ethnicity and occupations. These findings confirm that these factors were associated with the study from (Singh et al.,2000; Ounvichit & Yoddumnern-Attig, 2018), especially incentive-driven factor of participation.

Conclusions

In the case of MMCA, this study has demonstrated that local people inside and outside of the mangrove group have a positive attitude towards conservation activities. Despite top-down management by the government that impacted limited access to the activities, local people still have access to the activities through mangrove conservation group, although the number was likewise limited. Connections to the government and the mangrove group were the key to getting access to the activities, which in this study derived from social dynamics by emphasizing the heterogeneity context. Such conditions were also related to local people's reasons to participate, particularly by the member of the mangrove group. The finding of this is essential for the government to implement the appropriate management that equitable for local people by considering their social dynamics.

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Aplication of Microbubble Oxygenation on Water Quality Improvement in Fish Culture

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Abstract

Oxygen is a limiting factor for fish life. The proper method of adding oxygen into the water will be able to improve water qualities which in turn increase the viability of tropical fish. The expected water quality is not only able to meet the needs of fish but also stable availability. Therefore, this study examines the use of microbubble as an oxygen supply compare to the conventional systems for water quality stability. The study was conducted experimentally to compare the performance of microbubble oxygen system with conventional aeration system in fish culture media. The results shows that microbubble oxygen system could increase oxygen levels up to 7.27% higher than the conventional aeration. In addition microbubble aeration is able to maintain temperature and oxygen stability during extreme conditions in the early day compared to the conventional aeration. Fish with more stable oxygen supply are more aggressive and agile than fish with less stable oxygen supply.

Keywords: *Fish, Oxygen, Microbubble*

Introduction

The aquaculture industry is still the leading field in fisheries. The high demand for fishery products from both domestic and international triggers an increase in technological innovation in aquaculture. Good water quality management is an important factor for the success of aquaculture in providing a suitable environment for fish growth. Good water quality will also support fish health conditions. Water quality parameters in aquaculture that must be monitored periodically are temperature, pH, ammonia, suspended solids, and dissolved oxygen. Dissolved oxygen is a very important and critical limiting parameter, the availability of which must be sufficient and stable.

One of the innovations is to maintain dissolved oxygen levels in water using microbubble aeration water (air aeration with microbubble). This technology has been widely used, among others, to inject air in general, or gases in particular, for example ozone which functions for sterilization while increasing dissolved oxygen levels.

The oxygen supply can be accomplished by aeration and diffusion. Microbubble technology is an aeration system that is effective in dissolving oxygen in water with a high level of efficiency (Takeuchi, 2017). Microbubble is able to save on feed costs, such as in Pagrus major cultivation by 20%, due to sufficient dissolved oxygen requirements (Endo et al., 2008). The effectiveness and efficiency of oxygen transfer from microbubble has the potential to be used as an aeration system in fish farming. The movement and circulation of water in the pond generated by the aeration system is also an important factor that has an indirect effect on the even distribution of oxygen. The problem faced in the aeration system is the turbulence of suspended materials and other particles that cause water turbidity. High turbidity can reduce the visibility of fish in the water for feeding and movement. So we need an aeration technology that can provide sufficient and stable oxygen supply but with low turbidity. Therefore, this study aims to examine the performance of microbubble aeration compared to conventional aeration using aerated stones on water quality.

Materials and Methods

The research method uses experimental methods in the laboratory. Treatment consists of applications of microbubble aeration and conventional aeration using aerator, with replications. Water quality parameters tested were dissolved oxygen (DO), temperature, pH, and turbidity represented by TDS. The experimental design schematic is in the following figure.

Water quality parameters include DO, temperature, pH, total dissolved solid which is measured twice a day, at 04.00 and 14.00. The collected data were analyzed by T-test to obtain the type aeration installation suitable for aquaculture

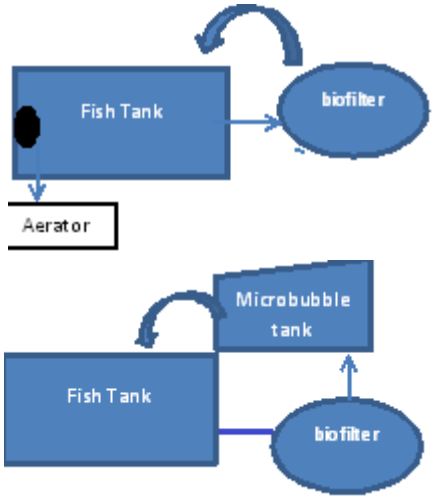

Figure 1. conventional aerators (Left) and microbubble aeration (Right)

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Results and Discussions

Measurement in the morning is intended to determine DO at a critical time where at night until the morning before sunrise there is a drastic decrease in oxygen. The results of microbuble trials compared to conventional aeration systems can be seen in Figures 2 and 3.

The measurement results above show that the water quality is still in the optimal range for fish growth. whereas Figures 3 and 4 show that the use of MBG provides better water quality than conventional aeration. Based on SNI 2011, the optimal ranges for freshwater fish include temperature 24 - 28 ° C, pH 6.5 - 9, and dissolved oxygen (DO)> 3 mg / L. The increase in DO content in the maintenance medium was due to the addition of air through aeration and MBG into the water, but the better result was the use of microbubble. In general, the low temperature in the morning before sunrise is the lowest point for oxygen, but using MBG can increase DO by 7.27% compared to regular aeration. In addition, MBG is able to maintain temperature stability in the morning. The mechanism of MBG to increase DO is to create a difference in outside air pressure with the fluid pressure in the pipe to the point of vacuum pressure so that air (gas) is sucked into the fluid flow through small holes in the pipe wall (Hidayat, 2008). Then the flow of air that enters together with water in a line will produce micro bubble air. DO in the form of micro bubbles is what water organisms will use to breathe. During the day, there is a slight decrease in DO compared to the morning, this can be caused by the activity of fish and other organisms, such as bacteria.

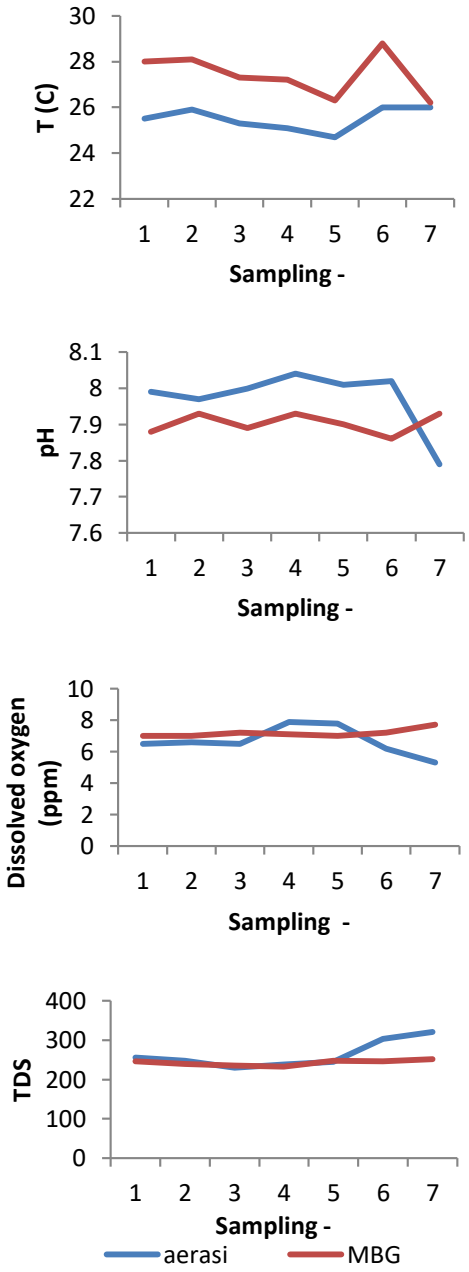

Figure 3. Water quality parameters in the morning

According to Afisna and Juwana (2020), the increase in DO value causes an increase in the number of bacteria to carry out the activity of decomposing wastewater. Increasing oxygen supply will accelerate the regeneration process of aerobic bacteria to decompose waste, namely ammonia.

If there is temperature stress, it will interfere with the physiology of the fish, resulting in decreased metabolism. At a drastic decrease in temperature the fish will lose their appetite, so that when the temperature is cold, the feed dose must be reduced. Fish can survive at temperatures of 10-30 ^{o}C. However, the ideal condition is 24-28 ^{o}C with a water

pH range of 7-8. Drastic changes in temperature and pH are very vulnerable when this happens to fish. Therefore it is recommended when changing the water, and leaving 30% of the old water to be mixed with new water (Nizar, 2013).

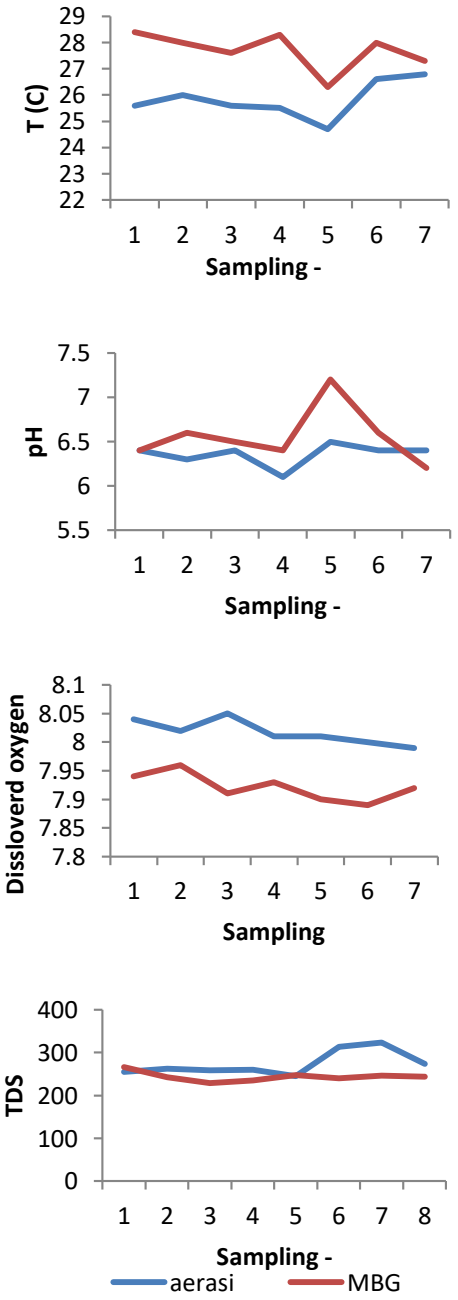

Figure 4. Water quality parameters during the day

Temperature and DO have different patterns. This is consistent with the statements of Lesmana (2005) and Boyd (2020), that the temperature and dissolved oxygen levels are inversely proportional, the greater the temperature, the smaller the dissolved oxygen content. Meanwhile, the water used as a living medium for goldfish must have a balanced ratio of carbon dioxide gas (CO2) and oxygen gas (O2). If the CO2 level is higher, it will result in death. Watson et al. (2004), confirmed that goldfish can live in water that has an oxygen content of at least 5 mg / L, pH (7-7.8),

Until now there has been no study regarding the use of MBG as a source of oxygen for turbidity. MGB performance against turbidity is better compared to conventional aeration, which is indicated by the lower turbidity of MBG compared to ordinary aeration. High water turbidity can affect fish activity, especially eating, because fish cannot see their food. Microbubble is able to reduce turbidity by up to 8% compared to conventional aeration.

Conclusions

The results of the microbubble aeration trials that have been made show that MBG can increase dissolved oxygen levels in water by up to 7.27% and reduce turbidity by 8% compared to conventional aeration.

Acknowledments

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Secondary metabolites and DPPH-radicals scavenging activity of crude methanol extract of *Gmelina elliptica* leaves from Berau District, Indonesia

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Abstract

Some researches were reported that Gmelina elliptica has antioxidant activities. However, antioxidant activities of G. elliptica leaves from Berau district have not been reported. This research was designed to know the ability of crude methanol extract of G. elliptica leaves (CMGEL) to scavenge DPPH-radicals. The Leaves of G. elliptica were collected from a villager at Talisayan village, Berau District, East Kalimantan, Indonesia. The dried leaves were extracted using methanol for 24 h. and the filtrate was evaporated using an evaporator to yield the CMGEL. The secondary metabolites were tested qualitatively by using colour tests. Total phenolic content (TPC) and total flavonoid content (TFC) were tested using Folin-Ciocalteau and aluminium chloride methods, respectively. Antioxidant activity of the CMGEL was tested using DPPH-radicals scavenging assay. The results show that the CMGEL contains alkaloid, flavonoid, phenolic and terpenoid. The TPC and TFC of the CMGEL were 268.75 ± 26.52 mg/g extract and 2.05 ± 0.32, mg/g extract, respectively. The antioxidant activity of CMGEL to scavenge DPPH-radicals was 62.12±0.63% at the concentration of 15 ppm. This preliminary research shows that the G. elliptica leave from Berau district has potency as antioxidant agent.

Keywords: *Antioxidant, DPPH, Gmelina elliptica, leave, secondary metabolites*

Introduction

Gmelina elliptica, also known as *G. asiatica* L. is an Asian Bushbeech that growth as small tree or large shrub belonging to Lamiaceae family (Jeeva, et al., 2019; Mohan, et al., 2019). The plant is used as traditional medicine to treat some diseases (Jeeva, et al., 2019; Kannan, et al., 2012; Mohan, et al., 2019). The plant contains secondary metabolites such as alkaloids, cardiac glycosides, furans, flavonoids, phenolics, phytosterols, saponins, steroids, tannins, and triterpenoids (Jeeva, et al., 2019). Some extracts from leaf, root, wood, bark, seed, fruit, and aerial parts of *G. asiatica* have pharmacological activities such as anti-inflammatory, anticancer, antihyperglycemic, antihypoglycemic, antimicrobial, antioxidant, antiproliperative, antipyretic, hepatoprotective, and nematidical (Jeeva, et al., 2019; Mohan, et al., 2019). Research on the antioxidant activity of the *G. elliptica* leaves is rare. On the other hand, a species plant from different location shows different in its antioxidant activities (Nurlaili, et al., 2019). This research was conducted to investigate antioxidant activity of the *G. elliptica* leave methanol extract.

Materials and Methods

Sample and Chemicals

Leaves of *G. elliptica* collected from a villager at Talisayan village, Berau district, East Kalimantan province, Indonesia. The plant was identified by Dr. Syafrizal, M.P., Laboratory of Anatomy and Systematics Plant, Faculty of Math and Natural Science, University of

Mulawarman. The voucher specimen (XIX.Ver.G/1) deposited at Laboratory of Biology, Faculty of Teacher Training and Education, University of Mulawarman. The leaves were cleaned and dried under shade for a week. The dried leaves were extracted with methanol using batch technique for 24 hours then filtered using filter paper. The filtrate was evaporated using a rotary evaporator at 39-40^{o}C to yield a crude extract. The crude extract was kept in desiccator before further usage. All used chemicals were purchased from Merck and Sigma-Aldrich.

Phytochemical screening tests

Screenings of phytochemical test were using coloring method to know the secondary metabolites presence in the extract (Sukemi, 2016).

Determination of total phenolic content (TPC)

Determination of the TPC was done by using Folin-Ciocalteau method that described by Sukemi et al. (2016) with some modifications. Into 0.40 ml of various concentrations of gallic acid (GA) standard or extract solutions, 2.00 ml of diluted (10 time) Folin-Ciocalteau reagent was added. The mixture was mixed using vortex homogenizer and followed by the addition of 1.6 ml of 7.5% sodium carbonate solution. The mixture was mixed using vortex homogenizer and kept for 2 hour at room temperature. Absorbance of the mixture was monitored using UV-Vis spectrophotometer at 760 nm. The TPC of the extract was performed as milligram GA equivalent (mg GAE) using equation of linear regression of the GA standard.

Determination of total flavonoid content (TFC)

Colometric method (aluminium chloride) was applied on the determination of the TFC of the extract (Sukemi, et al., 2015). Into 2 ml of various concentrations of the extract or quercetine standard solutions, 2 ml of 2.00% aluminium chloride was added, and followed by homogenizing using vortex homogenizer. The homogenized mixture was left for an hour at room temperature. The absorbance of the mixture solution was read at 420 nm by using UV-Vis spectrophotometer. The TFC of the extract was calculated as milligram quercetine equivalent (mg QE) using equation of linear regression of the quercetine standard.

Determination of antioxidant activity

DPPH-radical scavenging assay was used to measure the antioxidant activity of the extract and ascorbic acid (Sukemi, et al., 2015). Into 2 ml of 0.1 mM DPPH-radical solution in methanol, 2 ml of each concentration of the extract solution in methanol or ascorbic acid solution in methanol was added. They were mixed by using vortex homogenizer and left for 30 min. at dark condition. Then, the absorbance of the mixture was read by using UV-Vis spectrophotometer at 517 nm. The scavenging activity of the extract and ascorbic acid were performed as percentage of scavenging activity (SA) follows

$$SA\ (\%) = [1-((A_1-A_2)/A_0)] \times 100$$

where A_0 is the absorbance of DPPH without the extract/ascorbic acid presence, A_1 is the absorbance of the DPPH and the extract/ascorbic acid mixture and A_2 is the absorbance of the extract/ascorbic acid without the DPPH presence).

Results and Discussion

The crude methanol extract of *G. elliptica* leave was dark green solid. Alkaloid, flavonoid, phenolic and terpenoid compounds were detected in the extract. This result is in accordance with the previous study conducted by Savithramma et al who reported that aqueous extract of *G. elliptica* leave contain alkaloid flavonoid, pehnolic and triterpenoid (Savithramma, at al., 2012). The extract contained 268.75 ± 26.52 mg GAE/g extract of the TPC and 2.05 ± 0.32 QE mg/g extract of the TFC. The antioxidant activity of the extract of *G. elliptica* leave is shown in the Fig. 1.

According to the Fig. 1, it is clear that the activity of *G. elliptica* leave methanol extract to scavenge DPPH-radicals increased with its concentrations. Compared with ascorbic acid, the extract showed low performance, the ascorbic reached 91.38±0.00% at the concentration of 0.15 ppm (data is not shown). However, the extract has potency as

antioxidant agent and further research on its activities are needed. There is a relation on the scavenging activity of an extract and its phenolic (Dudonné, et al., 2009). Phenolic and flavonoids compounds act as antioxidant agent and are able to donate theirs hydrogen to scavenge DPPH-radicals (Al-Amiery, et al., 2013; Amić, et al., 2003; Syamsu, et al., 2019). Thus, the activity of the extract to scavenge DPPH-radical might be caused by its phenolic and flavonoid contents.

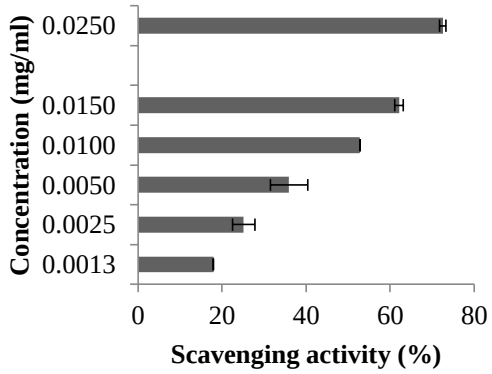

Figure 1. The DPPH-radicals scavenging activity of the *G. elliptica* leave extract.

Conclusions

The investigation of the ability of the methanol extract of the *G. elliptica* leave to scavenge DPPH-radicals has been done and the extract was potential as an agent to scavenge free radicals.

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Production Feasibility and Marketing Valuation of Oximata^{tm} As an Antioxidant Rich Functional Food Product

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Abstract

Oximata^{TM} is a multivitamin supplement product produced by Mulawarman University Samarinda, East Kalimantan. This supplement contains β-carotene and a-tocopherol in jelly premixes, making Oximata^{TM} also a functional food. Functional food products will develop rapidly in the future, including those closely related to foods that can inhibit the aging process, increase the body's immunity, and improve fitness. The market gives hope that the development of OximataTM in Indonesia is auspicious. This study aims to make business and marketing plans from Oximata^{TM}. The research method used is the Kano method to determine the general public's interests and opinions about Oximata^{TM} and then with SWOT to find out the internal and external factors of OOximata^{TM} products. Oximata^{TM} business planning is obtained based on the previous method's results to be translated into a Business Model Canvas (BMC). The best business planning model is obtained to support the Oximata^{TM} product development process. This research concludes that BMC planning shows sub-factors that must be improved, namely production and marketing.

Keywords: *OximataTM, functional food, Kano, SWOT, BMC.*

Introduction

Oximata is a multivitamin supplement product produced by Mulawarman University Samarinda, East Kalimantan. This supplement contains β-carotene, which plays a role in bone growth and maintenance of the macular eyes. Also, the content of Vitamin A and Vitamin C plays an active role in maintaining the immune system and the human body's fitness. This makes Oximata a multivitamin and functional food supplement.

Functional food products that will develop rapidly include those near related to food that can inhibit the aging process, increase body immunity, improve fitness, facial beauty, and appearance. This gives hope that the development of Oximata in Indonesia is very prospective.

Based on this background, the problem formulation is how to develop Oximata products. The purpose of this study was to determine which strategy was used to develop Oximata products.

Materials and Methods

From the research objectives above, various indicators will be reviewed and refer to the concepts and theories proposed in the research, resulting in research results (output) used as references or recommendations in determining the right strategic policies in planning and developing Oximata products in Samarinda. This research is descriptive analysis research.

This research was conducted in Samarinda City, East Kalimantan, from September to October 2020.

Results and Discussions

KANO Analysis

The Kano model helps us understand the entire spectrum of customer expectations and satisfaction. The canoe model's horizontal axis identifies (shows) how well the company's products or services meet customer expectations. The vertical axis shows the degree of customer satisfaction with the

products or services provided (Nur Hayati et al., 2018).

The following are the results of the Kano Method analysis:

Attributes in Reverse Category		
No.	Attributes	Category
1	Oximata has a bitter taste	Reverse

The table above shows that this attribute is included in the reverse category. An attribute that does not function should not affect the level of customer satisfaction.

Attributes in Indifferent Categories		
No.	Attributes	Categories
1	The presence of a sour taste in oximata	Indifferent
2	There is a pumpkin extract flavor to oximata	Indifferent
3	The emulsion texture on oximata is thick	Indifferent
4	The emulsion color of Oximata is orange	Indifferent
5	There was a raw scent on oximata	Indifferent
6	Oximata had a rancid scent	Indifferent
7	Oximata produces 300 ml packs	Indifferent
8	Oximata offers a price of IDR 16,000 - IDR 30,000	Indifferent

The table above shows that these attributes are included in the indifferent category. An attribute in the category is not noticed by customers so that the presence or absence of these attributes will not affect the decrease or increase in customer satisfaction.

Attributes in Indifferent Categories		
No.	Attributes	Categories
1	There is a sweet taste to Oximata	Attractive
2	Oximata manufactures supplements in capsule form	Attractive
3	Oximata produces 100 ml packs	Attractive
4	Oximata offers a price of IDR 10,000 - IDR 15,000	Attractive
5	Oximata is available at pharmacies	Attractive
6	Oximata is available at convenience stores	Attractive

The table above shows that this attribute is included in the attractive category. An attribute included in the category needs to be maintained because the level of customer satisfaction will be very high with the increase in attribute performance. However, the decrease in actual performance does not cause a decrease in the level of satisfaction.

Attributes in One Dimensional Category		
No.	Attributes	Categories
1	A listed halal label on the packaging	One Dimensional
2	Nutritional information listed on the packaging	One Dimensional
3	The expiration date is listed on the package	One Dimensional
4	Listed product brand on the packaging	One Dimensional
5	Listed by weight/net on the packaging	One Dimensional
6	Oximata is registered with the BPOM	One Dimensional
7	There is a combination of pictures and writing	One Dimensional
8	Oximata is nutritious for maintaining eye health	One Dimensional
9	Oximata is nutritious for maintaining body fitness	One Dimensional

The table above shows that these attributes fall into the one-dimensional category. An attribute included in the category is essential to prioritize because satisfaction is linearly related to an attribute performance.

SWOT Analysis

SWOT analysis compares the external factors of opportunity (opportunity) and threats (threats) with internal factors of strength (strength) and weakness (weakness). Internal factors are entered into a matrix called the Internal Strategic Factor Analysis Summary (IFAS) matrix. External factors are entered into a matrix called the External Strategic Factor Analysis Summary (EFAS) matrix. After the internal and external strategy factor matrices are completed, the results are included in a quantitative model, namely the SWOT matrix, to formulate its competitive strategy.

Here are the IFAS and EFAS factors:
IFAS
1. Strength
    a. Oximata contains beta carotene and alpha-tocopherol, which are beneficial for eye health and as antioxidants.
    b. Oximata contains vitamin A, vitamin C, and vitamin E, useful for maintaining body immunity.
    c. Oximata is a functional food group.
    d. Oximata is affordable.
    e. Readily available raw materials.
    f. Oximata has exciting packaging.
2. Weakness
    a. The shelf life of Oximata is short.
    b. The resulting taste is still strange.
    c. Many people do not know Oximata.
    d. Lack of promotion.
    e. Seasonal raw materials.

EFAS
1. Opportunity
    a. The level of public knowledge and insight on the importance of maintaining health continues to increase.
    b. Information technology and marketing continue to develop.
    c. The pandemic condition in Indonesia has resulted in an increasing need for oximata supplements.
2. Threat
    a. Competition of other products.
    b. They are changing consumer tastes.

Based on the IFAS and EFAS factors above, a SWOT analysis was carried out as follows:

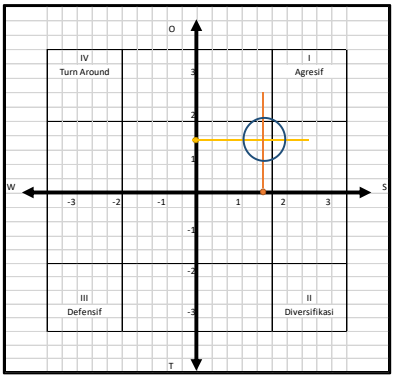
IFAS (Internal Strategic Factor Analysis Summary)				
No.	Strength	Weight	Rating	Score
1	A	0.14	3.71	0.53
2	B	0.13	3.71	0.47
3	C	0.14	3.57	0.51
4	D	0.22	3.14	0.68
5	E	0.20	2.86	0.56
6	F	0.17	3.57	0.61
Total Strength		1.00		3.37
No.	Weakness	Weight	Rating	Score
1	A	0.18	1.86	0.33
2	B	0.24	2.14	0.51
3	C	0.16	2.00	0.32
4	D	0.18	1.86	0.33
5	E	0.24	2.57	0.63
Total Weakness		1.00		2.12

The table above is the IFAS table and shows these values based on the level of importance. The total value of Strengt 3.37 and Weakness 2.12. The difference between the two is 1.25.

EFAS (Eksternal Strategic Factor Analysis Summary)				
No.	Opportunity	Weight	Rating	Score
1	A	0.31	3.29	1.02
2	B	0.31	3.29	1.02
3	C	0.38	3.14	1.20
Total Opportunity		1.00	0	3.23
No.	Threat	Weight	Rating	Score
1	A	0.43	1.71	0.74
2	B	0.57	2.14	1.22
Total Treat		1.00	0	1.96

The table above is the EFAS table and shows this value based on the level of importance. The total value of the opportunity is 3.23, and the Threat is 1.96. The difference between the two is 1.27.

From the difference between the values of IFAS 1.25 and EFAS 1.27, the intersection of the points is carried out using a SWOT diagram. The following is the result of the intersection of the lines:



IFAS / EFAS	Strength	Weakness
Opportunity	Strategy SO (Aggressive) 3.37 + 2.12 = 5.49	Strategy WO (Turn Around) 2.12 + 3.23 = 5.35
Threat	Strategy ST (Diversification) 3.37 + 1 .96 = 5.33	Strategy WT (Defensive) 2.12 + 1.96 = 4.08

The SWOT diagram above shows that the intersection point is in quadrant I. Quadrant I is an aggressive strategy quadrant. Also, the diagram shows that the product is Oximata.

Have high strength and opportunity so that further development is needed. Moreover, the type of strategy used is an aggressive product development strategy.From the table above, it can be concluded that the value of SO Strategy = 6.6, the value of ST Strategy = 5.33, the value of WO Strategy = 5.35, and the value of Strategy WT = 4.08. This value determines the order of using the strategy from the largest to the smallest value. So that the order is obtained, namely, SO Strategy, WO Strategy, ST Strategy, and the last WT Strategy.

It is known that the most significant value is the SO Strategy, with a value of 6.6. Therefore, planning for the growth and development of Oximata uses the SO Strategy. The following is a SWOT analysis table of each strategy to determine what strategies the Oximata Company should undertake.

The strategies obtained based on the SWOT analysis are:

1. With technology and information, the marketing strategy is online trophies.
2. The process of delivering products to consumers must be faster.
3. Offer a lower price for Oximata products.
4. Oximata is packed with attractive packaging.

BMC Analysis

The Business Model Canvas is a tool to help us see more accurately what kind of business that is, or we are going to be doing. Changing a complex business concept to a simple one that is displayed on a single canvas sheet containing a business plan with nine key elements that are well integrated into it includes both internal and external strategy analysis (Osterwalder and Pigneur, 2015).

This canvas divides the business model into nine main components, then separated again into the right (creative side) and left (logical side) components, just like the human brain. The nine components are as follows (sorted from right to left) Customer Segment, Customer Relationship, Customer Channel, Revenue Structure, Value Proposition, Key Activities, Key Resource, Cost Structure, and Key Partners.

Conclusions

Strategy determination is crucial in planning the growth and development of production activity. It is this strategy that determines the processes and results that producers want. There are several considerations for determining strategies in the case of oximata, including:

1. Consumers prefer products that have good taste, attractive packaging, low prices, and products that have been verified by food institutions.
2. The marketing strategy used is aggressive, namely, online marketing.

Here are of the Bu Model Ca design:		*Designed for:*	*Designed by:*	*Date:*	*Version:*
Business Model Canvas		Oximata	Himawan Adi P		

Key Partne	**Key Activities**	**Value Propositions**	**Customer Relationships**	**Customer Segments**
Supplier Supermarket Apoterk Reseller	Production Platform/network Promotion	Oximata contains beta carotene and alpha-tocopherol, which are beneficial for eye health and antioxidants. Oximata contains Vit A, Vit C, and Vit E, which are useful for maintaining body immunity. Oximata is a functional food group and innovative food. The price of oximata is affordable. Oximata has attractive packaging. Oximata is made from fresh ingredients.	Automated service Personal assistant	Adults aged 30 years and over Post eye surgery patients
	Key Resources Formulator Employees Financial department Tools & Materials Building Transportation		**Channels** Advertisement Supermarket Social Media Website Apotek	

Cost Structure	**Revenue Streams**
Cost Driven	Sales Advertising

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Characterization of Honey Farmers and Honey Potential by Region in East Kalimantan

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Abstract

East Kalimantan is one of the provinces in Indonesia that can become a honey development area. Honey is a natural sweet solution produced by honey bees, both stinging honey bees (Apis sp.) and stingless honey bees (Trigona sp.) from flower nectar. Forest honey is mostly found in East Kalimantan, considering that the area has endemic trees with a height of more than 40 meters, a habitat for Apis dorsata bees. This research was conducted to determine the best location to develop honey and to determine the characteristics of honey farmers in East Kalimantan. The research method used is the Location Quotient (LQ) and Descriptive Analysis method. The results showed that the amount of honey production in each region varies based on the amount of feed available. The regions with the forest honey potential are Kutai Kartanegara and Penajam Paser Utara, with LQ values of 1,000419 and 0.99962, respectively. In contrast, the regions with potential for cultivated honey are Samarinda and Penajam Paser Utara, with LQ values of 2386,417 and 1,907607, respectively. In summary, the areas with the best potential for producing forest honey are Kutai Kartanegara Regency. The areas with the potential for producing cultivated honey are Samarinda and Penajam Paser Utara because the LQ value is > 1. Cultivated and forest honey farmers in East Kalimantan are men aged 30-50 years were farming/collecting beehives as a side job. Based on their characteristics, honey farmers in East Kalimantan are farmers of productive age, have a senior high school education level, and use traditional harvesting methods.

Keywords: *East Kalimantan, K-means, Location Quotient, Forest Honey*

Introduction

East Kalimantan is one of the provinces in Indonesia, which is located between 2˚33 'North Latitude - 2˚ 25' South Latitude and 113˚ 44 'East Longitude - 119˚ 00" East Longitude, based on its astronomical location, East Kalimantan is one of the provinces through which this line passes equator (BPS East Kalimantan, 2020). Kalimantan consists of three cities and seven districts: Samarinda City, Bontang City, Balikpapan City, Paser Regency, West Kutai Regency, Kutai Kartanegara Regency, East Kutai Regency, Berau Regency, North Penajam Paser Regency, Mahakam Ulu Regency. East Kalimantan belongs to the tropics with a large forest area. Kalimantan Island has a forest area of 25,500,000 hectares. East Kalimantan has the potential for agro-industrial development of forest honeybees because it has various endemic trees with a height of more than 40 meters.

Honey is one of the products of non-timber forests (HHBK) that has high commercial value. According to the Indonesian National Standard (SNI) 01-3545-2013, honey is a natural liquid that generally has a sweet taste produced by honey bees (*Apis sp.*) from floral nectar or other parts of plants (extrafloral). Honey can be divided into two, namely natural honey or forest honey obtained from forest bees (Apis dorsata) and cultivated honey obtained from cultivated honey bees (*Apis cerana*, *Apis mellifera, Trigona sp)*. Honey bees are insects that help the pollination process (*pollinator*) of various plants, both cultivated plants and wild plants (Mayasari et al., 2016). Honey bees are divided into two groups: stinging bees and stingless bees (Moissetdan Butchman, 2011). According to Syafrizal, 2012, there are nine types of Trigona sp. honey bees found in the Samarinda Lempake Education Forest. Meanwhile, according to Lestari (2015), forest honey can be found in Berau, Paser, Penajam Paser Utara, Kutai Kartanegara, East Kutai, and West Kutai Regencies.

Apriani et al. (2013) stated that honey's essential indicators for consumers are color, aroma, and taste. The color, aroma, and taste of honey are influenced by the type of plant the nectar source. The physical and chemical characteristics of honey vary depending on internal and external factors. Internal factors that influence are the type of honey bee feed. In contrast, the external factors are season, soil conditions, geographical location, processing, and storage processes. The color of honey will adjust the type of feed. If it comes from radish plants, it will be white like water. If it comes from acacia plants, it

will be bright yellow. Besides, if the honey storage time is extended, honey will change color to be older. The antioxidant content in honey consists of enzymatic and non-enzymatic antioxidants. Enzymatic antioxidants in honey are catalase, glucose oxidase, and peroxidase. In contrast, non-enzymatic antioxidants are ascorbic acid, flavonoids, amino acids, and protein (Evahelda et al., 2017). The honey content significantly affects the physicochemical properties of honey, such as moisture content, ash content, acidity, reducing sugar levels, and metal contamination properties.

Excessive honey consumption does not cause side effects on the body when consuming excess sugar; besides, forest honey also does not contain pesticides. Therefore many people use honey as a folk remedy. The potential of the honey industry in Indonesia is enormous to develop if appropriately managed. The use of honey is not only for consumption but can also be used in the pharmaceutical and cosmetic industries. Concerning the condition of the world being hit by a pandemic, many people are looking for honey to be an immune booster.

However, honey production in Indonesia is still not comparable to honey consumption. This can be seen from the difference in exports' value, and Indonesia's honey imports in 2015 are still high. The highest import value for the last five years was US$7,402 in 2015, while the export value in the same year was US$756 (Ministry of Industry, 2016). One of the provinces that have the potential for honey development in East Kalimantan. However, it is unknown which areas have the most potential and characteristics of farmers in these areas. However, it is not yet known as the most potential areas and characteristics of farmers in the region. Therefore, there needs to be research related to identifying potential regions using the Location Quotient (LQ) method and characterization of honey farmers using descriptive analysis.

Based on this background, the leading formulation is where the most potential honey production is located and how the characteristics of honeybee farmers and farmers in East Kalimantan.

This study aims to find out the potential areas of honey-producing and the characterization of honeybee farmers and breeders in East Kalimantan.

Materials and Methods

This research was conducted in 1 City and 2 Regencies of East Kalimantan, namely Samarinda City, Kutai Kartanegara Regency, and North Penajam Paser Regency for three months, starting from September to November 2020. The data will be analyzed at Mulawarman Samarinda University and Agroindustry Technology and Management Laboratory of the Faculty of Agricultural Technology, Jember University.

The ingredients are processed in the form of primary and secondary data. Primary data is data obtained from field observations, interviews, and questionnaires on honeybee farmers and breeders. Secondary data is obtained from library studies. The description of the required data can be seen in table 1.

Table 1.Primary data and secondary data of research

No	Type of data	Analysis Method	Collecting data method	Data source	Data description
1	Primary data	LQ	Interview	Farmers	1. The amount of forest honey production and total honey in each region 2. Total forest honey production and total honey in East Kalimantan
		Descriptive Analysis	Interview and questionnaires	Farmers	Age, education level, income, work experience
2	Secondary data	LQ, Descriptive Analysis	Literature	Papers, books, etc	Argument supporting data

This research uses a quantitative-qualitative approach. Qualitative methods will produce descriptive data such as speech, behavior, or writing derived from the observed research subject (Bodgan & Taylor, 1992: 21-22). The quantitative approach uses data instruments or data collection tools that will produce numerical data. Qualitative data collection methods are used to identify honey breeders/farmers' character and their influence on honey development in East Kalimantan. Quantitative data collection is used to calculate the amount of honey production. The data were obtained from field observations and interviews with eight farmers and honey breeders in East Kalimantan scattered in Samarinda City, Penajam Paser Utara District, and Kutai Kartanegara.

This data analysis uses the Location Quotient (LQ) method to determine potential areas based on economic bases or not in East Kalimantan Regency. The LQ method is commonly used to calculate the leading sectors of a region by determining export capacity and determining the degree of independence of a region's economic sector (Zaini, 2019). Priority analysis in this study was carried out using the amount of honey production in a district as the basis
for calculation. Here is an equation to calculate the LQ value:

$$LQ_i = \frac{\frac{v_i}{v_t}}{\frac{V_i}{V_t}}$$

Information

- LQ_i = the value for *location quotient* forest honey in an area
- v_i = total output/production of forest honey in an area
- v_t = total output / honey production in an area
- V_i = total output/production of forest honey in East Kalimantan province
- V_t = total output/production of honey in East Kalimantan Province

Based on the above calculation, the following results will be obtained:

$LQ_i \geq 1$: Forest honey becomes the basis or source of growth so that the region can be said to be a potential area. Commodities have a comparative advantage. The results are not only able to meet the needs of the region concerned. However, they can also be exported outside the region.

$LQ_i = 1$: Forest honey is classified as non-basis, so that the area is not considered a potential area. Its production is only sufficient to meet the needs of the region itself and cannot be exported.

$LQ_i \leq 1$: Forest honey is classified as non-basis, so that the area is not considered a potential area. The production cannot fulfill its own needs, so it needs supplies or imports from outside.

Descriptive analysis is used to characterize honey farmers/breeders based on demographic variables, including age data, education level, harvesting methods, work experience, employment, and monthly income of farmers/honey breeders.

Results and Discussion

This study obtained data from surveys and interviews with eight farmers and honey breeders in Samarinda City, Kutai Kartanegara Regency, and Penajam Paser Utara Regency. The results of in-depth interviews obtained honey production data in each district, as seen in Table 2.

Table 2. Data on the amount of honey production in East Kalimantan

Region	Volume (L)	
	Forest Honey	Cultivated Honey
Kutai Kartanegara	30800	0
Penajam Paser Utara	15000	84
Kota Samarinda	0	7,2
Total	45800	91,2

(Source: processed data, 2020)

The amount of honey production in each region varies due to the number of hosts and honey bee feed. Forest honey production is heavily influenced by forest sustainability because forest honey can only develop or make nests in host trees such as *banggeris, meranti, meranti batu, jelemu, melenah, kratongan, lahung, trake* trees, etc. Besides, natural flowers for bee feed derived from the forest are very influential to honey production. Bee feed can come from wildflowers or the flowers of plantation trees such as oil palms, acacia, and eucalyptus. The production of cultivated honey is influenced by the ability to cultivate farmers to innovate both feed innovation and the innovation of the breeding box and the place of honeybees.

The acquisition of forest honey is higher than cultivated honey. This is because the types of bees that produce honey are different. Apis dorsata bees produce forest, honey. Cultivated honey is produced by sting bees (*Apis cerena, Apis mellifera*, etc.) or stingless bees (*Trigona sp.).*

Table 3. Data on the amount of forest honey production and livestock honey

Region	Forest Honey LQ	Note	Cultivated honey LQ	Note
Kutai Kartanegara	1,000419	>1	0	<1
Penajam Paser Utara	0,99962	<1	2,80219	>1
Kota Samarinda	0	<1	503,193	>1

(Source: processed data, 2020)

Based on the production amount, data is then processed to determine which areas are classified as economic bases using the Location Quotient (LQ) method. If the value of LQ < 1, then the honey in the

region is classified as non-base. If the value of LQ = 1, then the honey in that area is classified as non-base, and if the value of LQ > 1, then the honey in that area is classified as the base. The calculation of LQ values in 1 city and two districts in East Kalimantan can be seen in table 3.

Based on the above data, can be known that the order of areas with potential of forest honey is Kutai Kartanegara Regency, Penajam Paser Utara, and Samarinda with consecutive LQ value of 1,000419, 0.99962; 0; while the order of regions with potential for cultivated honey is Samarinda, Penajam Paser Utara, and Kutai Kartanegara with consecutive LQ values 2386,417, 1,907607; 0. Based on the above results, it can be known that the area with the best forest honey-producing potential is Kutai Kartanegara Regency. In contrast, the area with the potential for producing cultivated honey is Samarinda and Penajam Paser Utara because the value of LQ > 1 means that the region can produce honey for the benefit of its region can sell it to other regions. There is a need for the characterization of honey farmers and breeders to determine a strategy for honey development in East Kalimantan. Demographic data of farmers and honey breeders can be seen in table 4.

All honey farmers in East Kalimantan are productive, with 62.5% in the 4th quarter of the productive age of 46-64 years old, while 37.2% are aged 36-45 years. The age of honey farmers/breeders can affect the level of the courage of decision making. Young people will have an act of higher courage to take risks. The level of education will affect the level of technology adoption and innovation in the honey business. Education that aligns with the field will strengthen business development capabilities. Farmers and honey breeders in East Kalimantan are average high school graduates with a percentage of 62.5%, 25% of undergraduate (S1), and 12.5% are doctoral graduates (S3). There are ¾ farmers, and honey breeders use traditional harvesting methods, as many as 25% of farmers use semi-traditional methods. This corresponds with the level of education and age of the identified farmer. The average farmer and breeder are at the end of productive age, and the average education is high school.

Work experience as farmers or honey breeders varies; there are 50% with 1-3 years of work experience, 25% with work experience for more than ten years, and 12.5% have 4-5 years of work experience and 6-10 work experience. This will affect honey production development due to the work experience of honey farmers/breeders will increase the level of knowledge, skills, and analysis of constraints of farmers/breeders on honey production.

Table 4. Data on farmer characters based on demographic variables

No	Description	Total (person)	Percentage (%)
1	Age		
	a. 15-25		
	b. 26-35		
	c. 36-45	3	37,5
	d. 46-64	5	62,5
	e. ≥ 65 t		
2	Education level		
	a. Elementary School		
	b. Junior High School		
	c. Senior High School	5	62,5
	d. Diploma		
	e. Bachelor	2	25
	f. Master		
	g. Doctorate	1	12,5
3	Metode Pemanenan		
	a. Traditional	6	75
	b. Semi modern	2	25
	c. Modern		
4	Experience Work		
	a. 1-3	4	50
	b. 4-5	1	12,5
	c. 6-10	1	12,5
	d. >10	2	25
5	Work		
	a. Student		
	b. Government employees	3	37,5
	c. Entrepreneur	1	12,5
	d. Farmer	3	37,5
	e. Etc	1	12,5
6	Rata-rata Pendapatan		
	a. <Rp 500.000		
	b. Rp 500.000 – Rp 1.000.000		
	c. Rp 1.000.000 - Rp 5.000.000	6	75
	d. Rp 5.000.000 – Rp 10.000.000	1	12,5
	e. >Rp 10.000.000	1	12,5

(Source: processed data, 2020)

The people of East Kalimantan, especially in Samarinda City, Kutai Kartanegara Regency, and Penajam Paser Utara Regency, make farming or cultivating honey bees a side job because almost all farmers/breeders interviewed have main activities, namely as civil servants and farmers respectively as many as 37.5 % and 12.5% have jobs like security guards. However, only 12.5% of farmers make honey farming their main job. In terms of average income per month, there are 75% with an average income of IDR1,000,000 – IDRRp5,000,000, 12.5% of farmers/breeders with an income of IDR5,000,000 - IDR 10,000,000 and > IDR 10,000,000.

Harvesting of honey and the treatment of honeybees should not be carried out daily. Harvesting forest honey and cultivated species *Apis sp.* can be done when the hive is ≥ three months old. In contrast, the honey harvesting of *Trigona sp*., it can be harvested every month if the maximum flower production. Forest honey farmers in the areas that have been studied have not applied the Dayak tradition when harvesting. Forest honey farmers in Kutai Kartanegara regency apply harvesting by merely taking a honey-filled hive and leaving a hive containing honeybee eggs. This is done to maintain the life cycle of honeybees, and the harvesting process will be shorter.

Conclusions

The potential area of forest honey producer is Kutai Kartanegara Regency. In contrast, the potential areas for cultivated honey production are Samarinda City and Penajam Paser Utara. In general, the people of East Kalimantan make farming and cultivating honey bees a side job. Honey farmers are included in the productive age, high school graduates, and still, use traditional harvesting technology. The development of forest honey can be done by improving work safety, product packaging, and forest preservation. Meanwhile, honey for livestock honey development can be done by providing feed innovation and packaging innovation.

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Development of Sustainability Dimension For East Kalimantan Honey Forest (Kalimantan Forest Honey Sustainability Dimensional Development)

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Abstract

Kalimantan is an Indonesian territory with a strategic forest area as a residence for forest honey-producing bees that have good profits and are beneficial to health, especially during this pandemic. However, forest honey sustainability is threatened in connection with relocating the capital to Kalimantan, so there is a need for research and analysis on the sustainability of forest honey in East Kalimantan. The analysis uses the Product Service System method, centered on the continuity of the three core aspects, namely the environment, socio-culture, and economy. The results showed aspects of sustainability that did not meet the requirements, namely the socio-cultural aspects where the implementation of Occupational Health and Safety (K3) was not maximized in the forest honey harvesting process. The recommendations formulated for this criterion are that honey squatters pay more attention to occupational health and safety by using personal protective equipment when working and paying attention to personal hygiene when finishing work.

Keywords: *Product Service System, Forest Honey, Dimensions of Sustainability.*

Introduction

East Kalimantan is one of the regions of Indonesia with the most extensive tropical rainforest areas. Based on the East Kalimantan Provincial Forestry Service data, the forest conserved by East Kalimantan Province in 2015 was 1,844,969 hectares. The tropical rain forest that is owned by Kalimantan is a strategic location as a place to live for bees because the source of bee food comes from plants and flowers that produce forest honey. In Kalimantan, several trees grow tall, one of which is the *Koompassia excelsa* species, commonly known as the *perching* tree where forest honey bees nest. The local community calls the beehive shade tree a sialang tree.

Forest honey is one of the natural products with a high selling value compared to honey produced by livestock bees. Forest honey is natural honey produced by honey bees forest with bees *Apis dorsata*, which takes the liquid nectar from flowers and converts it into sugars inverse and reduces water content to produce honey. Sakri Faisal M (2015) said in his book entitled "Madu dan Manfaatnya," this honey is known to be better because it contains more minerals and vitamins than other types of honey. Besides, forest honey does not freeze even though it is placed in the freezer for months because the moisture content is below 20%. *Apis dorsata* is a type of honey bee distributed initially over most of Indonesia and is known to have a high level of productivity. However, *Apis dorsata is* a wild bee that cannot be cultivated by harvesting, so it is only carried out through hunting activities in forest areas. Forest honey bees nest in sialang trees. There are no specific criteria for a tree that can become a sialang tree. However, the characteristic that stands out is that it is isolated and the largest among the average plant communities in its siege (Thomas et al.: 2009).

The sustainability of Kalimantan forest honey is currently facing threats in connection with the government's decision to move Indonesia's capital city to the Kalimantan region, especially Penajam Paser Utara Regency (In a CNN article entitled: *Why Should the Capital Move?*). The relocation of the capital city to the Kalimantan region poses a threat to protected forests, which causes land conversion to become urban land with skyscrapers becoming the center of government activities. Therefore, it is necessary to study the sustainable concept of the potential of forest honey bees using the main concentration of the Production and Service System, which is the development of the concept of Design for Sustainability (D4S) with the criteria of *people, profit, planet.*

Materials and Methods

The research was carried out in September 2020 - November 2020 in several East Kalimantan areas, namely Sepaku, Kutai Kartanegara, and Kota Bangun, where several people worked as side jobs as forest honey encroachers. The tools used include laptops, research questionnaires, work stationery, and Microsoft Office programs. In this study, the data required is in the form of information regarding

the flow of material and flow of information and the relationship between the business unit and all related parties from suppliers to buyers, data on the identification of strengths and weaknesses of forest honey production and an assessment of the sustainability of experts on the prospects for forest honey in East Kalimantan in the future.

This research begins with stage 1, namely interviewing forest honey farmers or commonly known as honey hunters, about the ins and outs of forest honey, both the obstacles and opportunities in this forest honey sale business. By combining the data obtained from research references such as books, journals, and other learning media with the results of field interviews, results are obtained in the form of information system maps and forest honey materials and tables of sustainable SWOT analysis of East Kalimantan forest honey. Drawing the system map serves to identify the existing system, the stakeholders involved, and identify the flow of material and information. Furthermore, continuous SWOT creation aims to identify existing strengths, weaknesses, opportunities, and threats. The sustainability SWOT analysis includes three aspects, namely, environmental, socio-cultural, and economical. The SWOT analysis results will later be included in the system checklist, which is used to analyze the criteria in the system that do not meet the sustainability aspects. The system checklist results will be prioritized to categories H, S, M, L, and N, with the highest category, namely H, as a priority for improvement.

Furthermore, in stage 2, namely the formulation and selection of recommendations. The formulation stage has several steps: making recommendation development questions, making a recommendation comparison worksheet, and making a recommendation feasibility diagram. Stage 3, namely detailing the selected recommendations, in which several recommendations will be selected, and detailed recommendation guidelines are made. Stage 4 is the evaluation of recommendations where the PSS radar is made to compare the current system's recommendations if they are to be implemented later. In the last stage, namely the PSS implementation plan, two steps must be taken: making a list of specifications and making a business plan for recommendations made.

Results and Discussion

1. East Kalimantan Forest Honey Production System Map

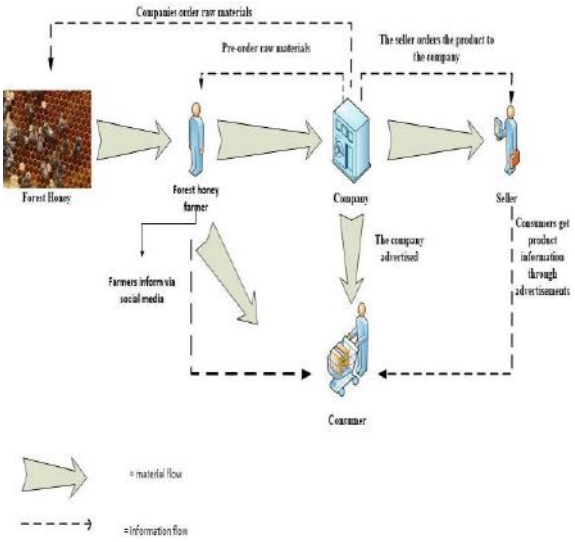

Figure 1. System Map Forest Honey

2. Sustainable SWOT
   Sustainable SWOT contains internal and external aspects contained in the production of forest honey in East Kalimantan. The sustainability of SWOT itself includes environmental, socio-cultural, and economic aspects. This SWOT was obtained from interviews with farmers or forest honey encroachers. SWOT can be seen in table 1.

3. Sustainability Criteria Categorization
   At this stage, questionnaires were distributed to forest honey farmers to determine what sustainability criteria needed to be developed. The questionnaire is given to forest honey farmers or people who understand the whole chain of forest honey encroachment systems. After distributing the questionnaires, the answers from each respondent will be recapitulated. The answer consists of two options, namely "YES" and "NO" with a "YES" value of 1 and a "NO" value of 0. The criteria' maximum score is the number of informants who filled out the questionnaire, and the minimum score is 0. For the number of answers, "YES" of each respondent with a maximum score of these criteria and a vulnerable score will be obtained from 0 to 1.
   Then do the calculation of the criteria categorization is done in the following steps (Arikunto, 1998):

1. Determine the highest and lowest score for each criterion. The highest score is one, and the lowest is 0.
2. Determine the range of scores, which is the difference between the highest score and the lowest score, and the range is 1.
3. Because there are three categories, namely High, Medium, and Low. Each category has an interval equal to the range divided by three (because there are three categories), namely one divided by 3. The result is 0.33.
4. It is found that the Low category has a score interval from 0-0.33, the Medium category has a score interval of 0.34-0.66, and the High interval has a score interval from 0.67-1.

4. Formulation of alternative recommendations
   The formulation of alternative recommendations is made to overcome problems in criteria that have high and moderate categories. From the results of the questionnaire, it is obtained the formulation of alternative recommendations as follows:

A. Occupational Health and Safety
   1. Use full personal protective equipment when working.
   2. Pay attention to body hygiene when finished work.

B. Justice or Industrial Relations
   1. Maintain permanent cooperation as a supplier of raw materials for the industry to strengthen its position in the market

C. Long term business development
   1. There are variations in the packaging of products that are sold to consumers directly.
   2. There is a label or trademark that the product uses when it enters the market.

Table 1. SWOT Sustainability of Forest Honey Production in East Kalimantan

SWOT	Current Situation		Upcoming Situation	
	Strength	**Weakness**	**Opportunity**	**Threat**
ENVIRONMENT	• Equipment can be used in the long run. • Estimated short harvest (once every three months) • Waste can be recycled. • Forest function booster	• Use of fuel for transportation	• Waste can be sold for cosmetic ingredients.	• Honey predatory animal
SOCIO-CULTURE	• Absorb much labor because of the work system in groups • All circles can accept honey.	• K3 equipment does not meet the standards. • There has not been a binding cooperative relationship with the industry.	• Creating new jobs for residents	• Has not mastered the processing of honey into processed products
ECONOMIC	• The selling price is proportional to the quality of the product.	• No permanent industrial partner	• Has no market competition	• Increase in freight tax or customs duties

Table 2. Results Categorization of sustainability criteria

Dimensions	Criteria	Score	Categories
Environment	Optimization of System Life	0	Not
	Reduction of Transportation / Distribution	0	Not
	Reduction of Resources	0	Not
	Minimizing Waste	0	Not
	Conservation	0	Not
	Toxicity	0	Not
Socio-cultural	Social responsibility	0	Not
	Occupational Health and Safety	1	High
	Product quality	0	Not
	Employment	0	Not
	Justice / Industrial relations	1	High
	Cultural Diversity	0	Not
Economy	Market position and competitiveness	0	Not
	Profitability	0	Not
	Added value for consumers	0	Not
	Long term business development	1	High
	Partnership / Cooperation	0	Low
	Macroeconomic Effects	0	Not

Conclusions

From the research conducted, it was found that there are two dimensions of sustainability identified from the forest honey business, namely:

- In the Socio-Cultural Dimension, two criteria need to be improved. The first criterion is occupational health and safety criteria, which have a high category, namely one on a rating scale of 0 to 1. The recommendation formulated for this criterion is to use complete personal protective equipment when working, which includes head protection, protective clothing, gloves, and shoes on harvesting forest honey and paying attention to body hygiene at work. Other criteria in the socio-cultural dimension that must be improved are fairness and industrial relations, which have a high category, namely one on a rating scale of 0 to 1. Recommendations that can be formulated for the criteria of justice and social relations are to establish permanent cooperation with companies to strengthen their position. in the market
- For the economic dimension, the criteria that need to be developed are the criteria for long-term business development. It has a high category with a score of 1 on a scale of 0 to 1. Recommendations that can be formulated in this dimension are the variations in the packaging in products sold to consumers directly so that consumers have more choices than the current situation. Regarding the number of needs to increase the selling value of the product as well as a marketing medium to the broader community, besides that, it is necessary to have a label or trademark that is used by the product when it enters the market, which also functions as a media for promotion and marketing to a broader audience.

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